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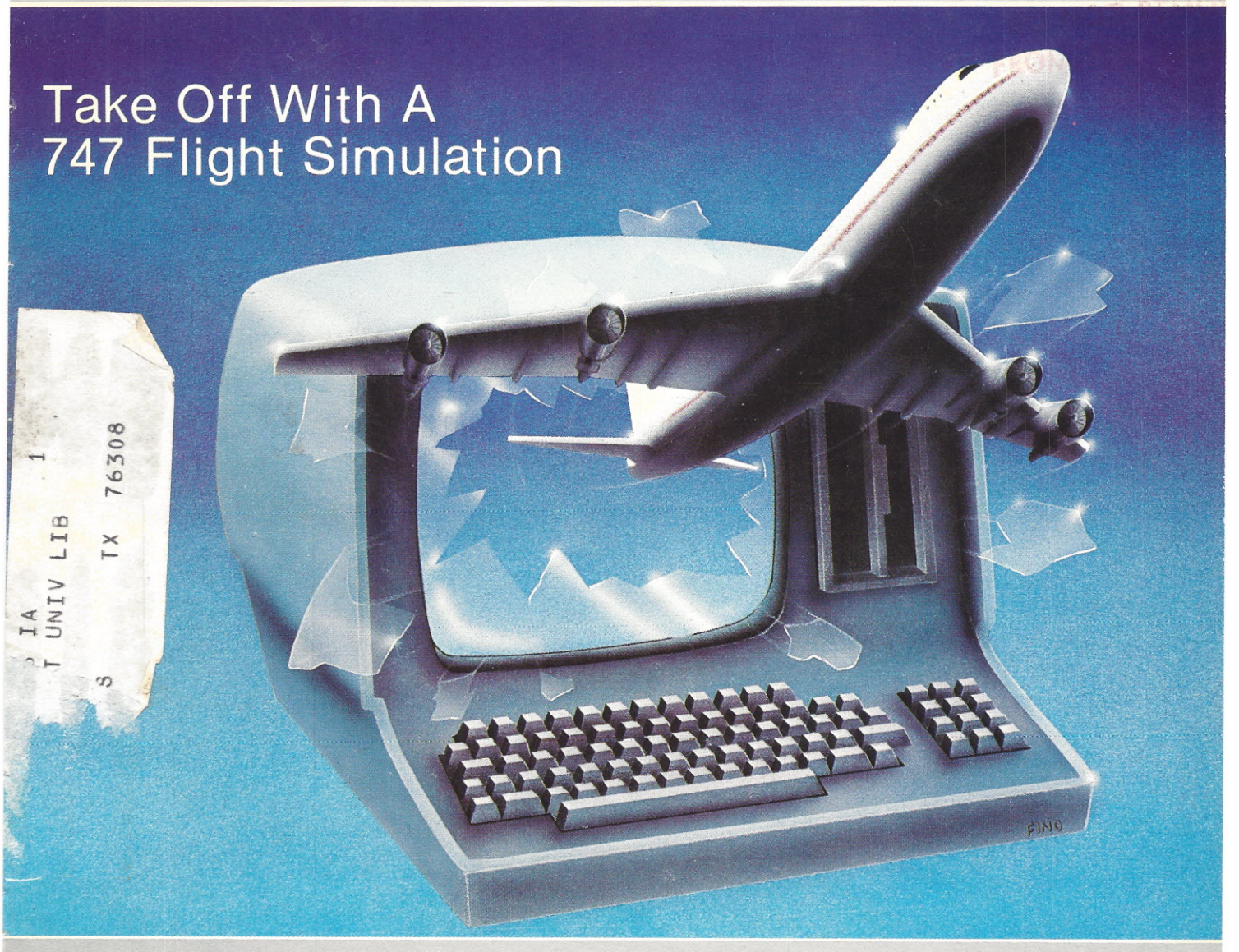
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The interface between the Model 16 hard disk and the Industrial Micro Systems computer is provided by the Hard Disk Controller. The Hard Disk Controller utilizes Direct Memory Access (DMA) for fast data transfer with minimum processor intervention. The maximum data transfer rate is 1.2 megabytes per second and the controller fully buffers the data, a sector at a time, to and from the disk. **Available in 220 V, 50 HZ Versions**

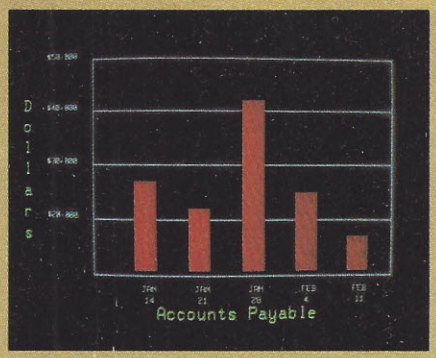
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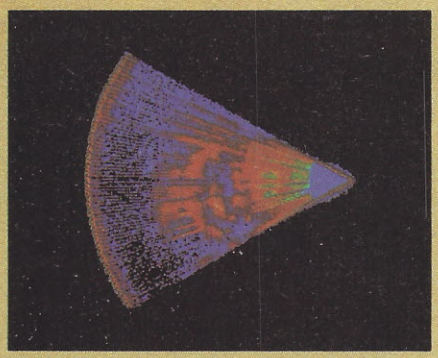
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Get the professional color display that has BASIC/FORTRAN simplicity

LOW-PRICED, TOO

Here's a color display that has everything: professional-level resolution, enormous color range, easy software, NTSC conformance, and low price.

Basically, this new Cromemco Model SDI* is a two-board interface that plugs into any Cromemco computer.

The SDI then maps computer display memory content onto a convenient color monitor to give high-quality, high-resolution displays (756 H x 482 V pixels).

When we say the SDI results in a high-quality professional display, we mean **you can't get higher resolution than this system offers in an** NTSC-conforming display.

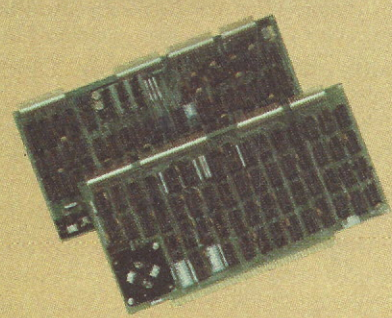
The resolution surpasses that of a color TV picture.

BASIC/FORTRAN programming

Besides its high resolution and low price, the new SDI lets you control with optional Cromemco software packages that use simple BASIC- and FORTRAN-like commands.

Pick any of 16 colors (from a 4096-color palette) with instructions like DEFCLR (c, R, G, B). Or obtain a circle of specified size, location, and color with XCIRC (x, y, r, c).

*U.S. Pat. No. 4121283

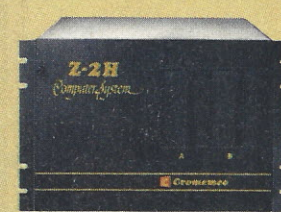


Model SDI High-Resolution Color Graphics Interface

HIGH RESOLUTION

The SDI's high resolution gives a professional-quality display that strictly meets NTSC requirements. You get 756 pixels on every visible line of the NTSC standard display of 482 image lines. Vertical line spacing is 1 pixel.

To achieve the high-quality display, a separate output signal is produced for each of the three component colors (red, green, blue). This yields a sharper image than is possible using an NTSC-composite video signal and color TV set. Full image quality is readily realized with our high-quality RGB Monitor or any conventional red/green/blue monitor common in TV work.



Model SDI plugs into Z-2H 11-megabyte hard disk computer or any Cromemco computer

DISPLAY MEMORY

Along with the SDI we also offer an optional fast and novel **two-port** memory that gives independent high-speed access to the computer memory. The two-port memory stores one full display, permitting fast computer operation even during display.

CONTACT YOUR REP NOW

The Model SDI has been used in scientific work, engineering, business, TV, color graphics, and other areas. It's a good example of how Cromemco keeps computers in the field up to date, since it turns any Cromemco computer into an up-to-date color display computer.

The SDI has still more features that you should be informed about. So contact your Cromemco representative now and see all that the SDI will do for you.

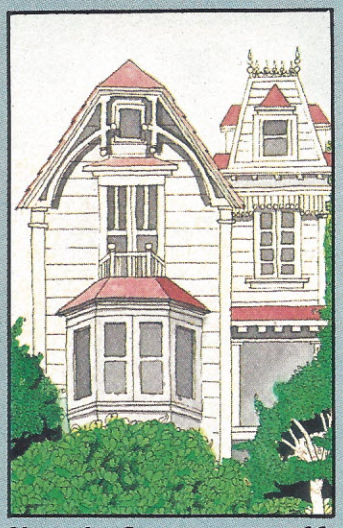
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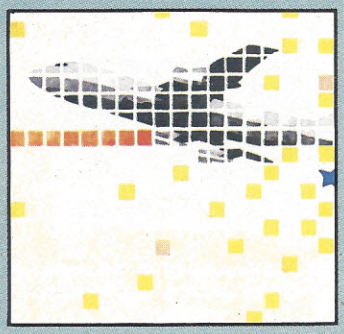
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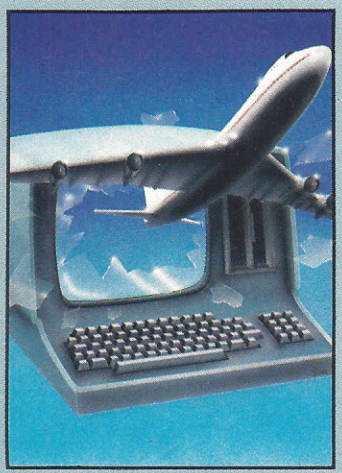
COMPUTING FOR HOME AND BUSINESS APPLICATIONS



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Cover by Fino Ortiz

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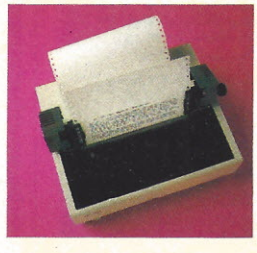
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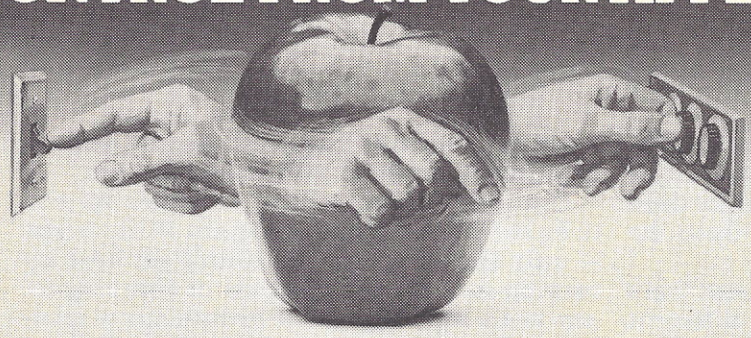
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Advertising

New England Region **Dick Green**
7 Lincoln St., Wakefield, MA 01880
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Eastern Region **John Sensenstein**
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Southeast Region **Harry Dill**
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Western Region **Mike Antich**
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(213) 926-9544

Japan **Tomoyuki Inatsuki**
Trade Media Japan Inc., R. 212 Azabu Hts., 1-5-10, Roppongi, Minato-ku, Tokyo 106
Telephone: (03) 585-0581 Telex: J28208

Interface Age Europe

Director, European Operations **H.L. Grohmann**
Dahlienstr. 4, D-8011 Munchen-Vaterstetten
West Germany
Telephone: 08106/7396

International Newsstand Distribution

Director **Lew Ullian**
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West Germany
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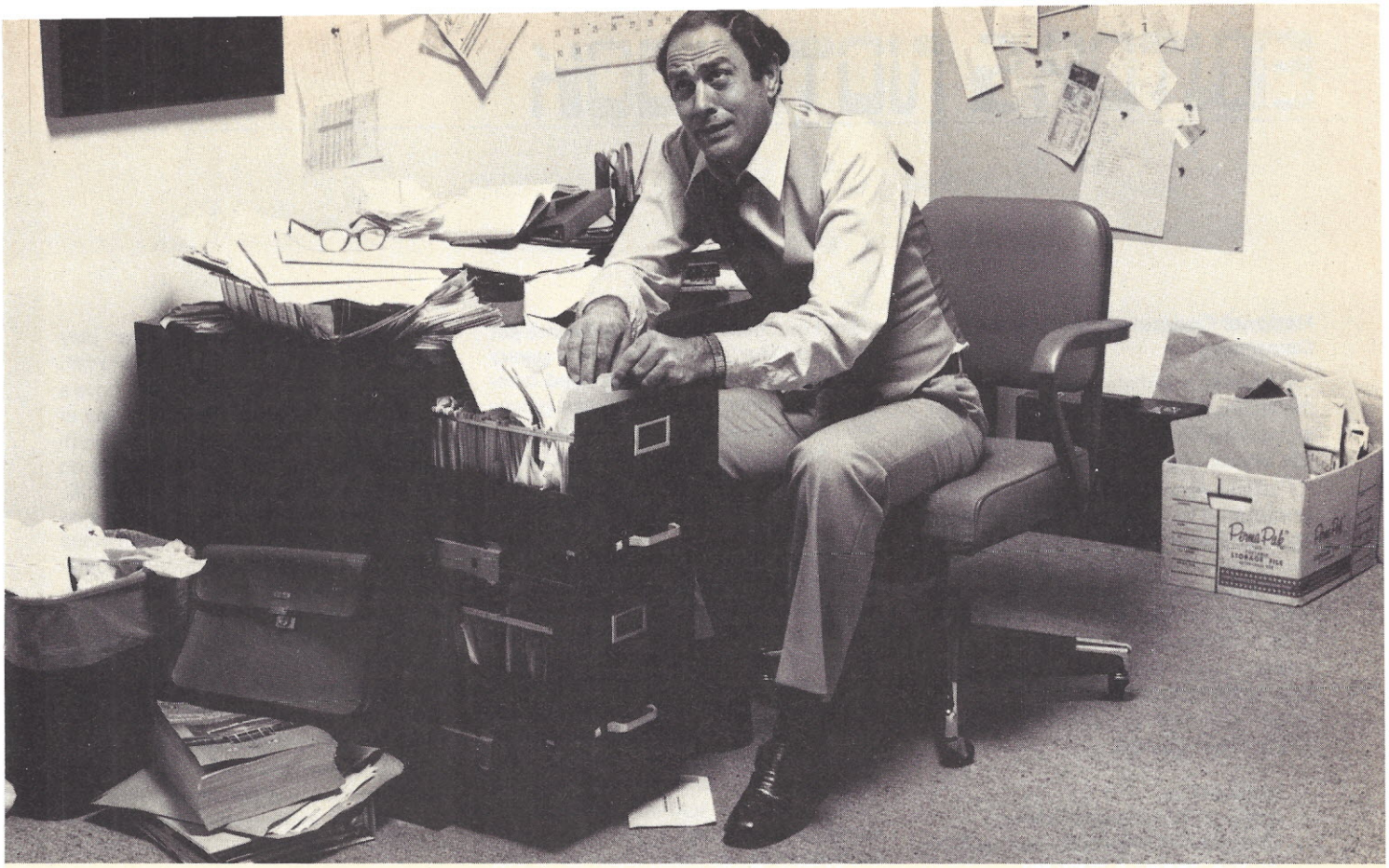
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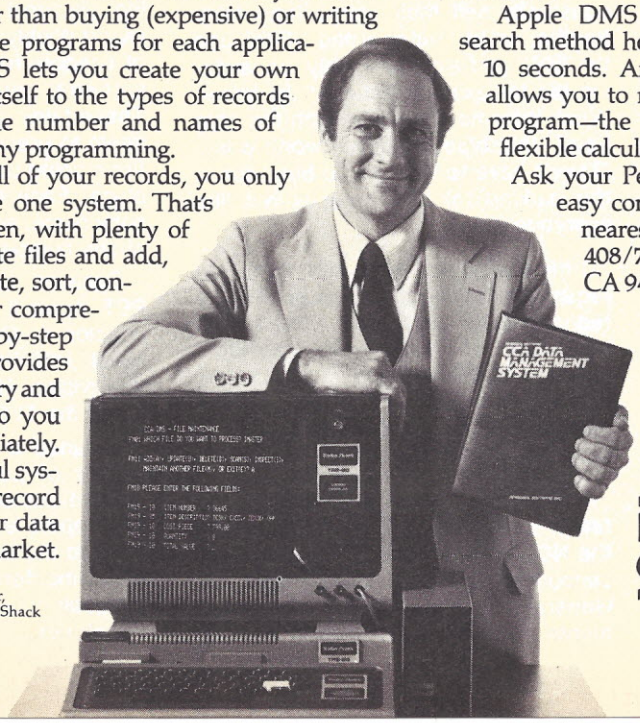
Having information at your fingertips can make your job a whole lot easier. And that's what the CCA Data Management System is all about.

With this Personal Software™ package and an Apple II™ or TRS-80™ disk system, it will be far easier to keep inventories, customer lists, accounts receivable and payable records, patient histories and many more items.

In fact, you can use the CCA DMS for all of your data management needs, rather than buying (expensive) or writing (time consuming) separate programs for each application. That's because DMS lets you create your own filing systems, adapting itself to the types of records you keep. You specify the number and names of each data field—without any programming.

With DMS keeping all of your records, you only have to learn how to use one system. That's easier, too. It's menu driven, with plenty of prompts to help you create files and add, update, scan, inspect, delete, sort, condense and print data. Our comprehensive 130-page step-by-step instruction manual even provides complete "how to" inventory and mailing list applications so you can start processing immediately.

DMS is a very powerful system, with more file and record storage capacity than other data base programs on the market.



And it also gives you greater data handling flexibility. To customize DMS, write add-on BASIC programs that read or write DMS files and perform any kind of processing you want.

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Ask your Personal Software dealer to show you how easy computerized record keeping is. To locate the nearest dealer, contact Personal Software Inc., 408/745-7841, 1330 Bordeaux Drive, Sunnyvale, CA 94086.

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PERSONAL SOFTWARE

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EDITOR'S NOTEBOOK

National Computer Conference Comments

I have a love/hate relationship with the National Computer Conference that is probably shared by many who attend this annual affair.

I attend every NCC regardless of my employer. I've attended it as a newspaperman working for one of the large weeklies in the computer industry, I've attended as a PR man for one of the large mainframers, and I've attended it in an editorial capacity for IA.

Like many "veterans" of the tour, I've noticed that every NCC is the same, yet vastly different. Certain things never change:

Crowds (big)
Pressroom danish (tasteless)
Computerworld buttons (suggestive)
Booths (bigger & brighter)
Sessions (overcrowded or empty)
Registration (time consuming)
Floors (hard)
Handouts (four color)
Parties (numerous)

But there are subtle changes at every NCC, some of which may become trends, or mark the passing of trends.

The personal computing exhibit will no longer be a separate entity, since AFIPS has announced that the exhibits will be housed on the main floor. (This has tremendous comic possibilities—imagine for a second a small microcomputer company being placed next to IBM, DEC or Honeywell. What we will have is a modern-day remake of David and Goliath—micros versus mainframes. I suspect that the fur will really begin to fly when a user asks his mainframe vendor for certain applications and is told that they will cost the equivalent of three small South American countries. Wandering into the micro maker's booth, the same user may find out that the sought after application costs about $9.99 plus tax, postage and handling. Micros will be back in the garage the following year.)

Sonny wasn't out front this year!

One of the most familiar sights to habitual NCC attendees is the sight of Sonny Monosson, founding father of American Used Computers in Boston, pacing back and forth by the show entrance with his crew cut, 1950s bow tie and signboards. Yes, signboards. Sonny wasn't recommending that everyone eat at Joe's Diner or some equally famous beanery, but he was selling used computer equipment. Gear that was generally one generation old, with a few years use, but capable of crunching numbers with the best of them—provided the user didn't need the fastest or newest system around.

It seems that two years ago, the people whose computers Sonny sold the second (and often third) time around pressured AFIPS to lean on Sonny and have him sign an agreement to either take a booth, stay away from the show or visit the local jail. Alas, faced with the slammer, Sonny signed an agreement to move inside this year (AFIPS 1, free enterprise 0). I think we all lost when Sonny lost. He told me that people would walk up to him and just say hello, remembering him from show to show, wishing him the best and inquiring as to the state of his business. They were just making conversation, people who only knew Sonny from seeing him in front of convention centers, saying hello to one of the few remaining personalities in the industry. I used to do the same thing, and came to know him in the same manner, though he doesn't know me from any of the other thousand nameless faces that say hello to him each year.

Some other things will change like the personal computer show vendors who constantly sell their wares from their booths, while "outsmarting AFIPS and the IRS" and simultaneously jeopardizing the tax-exempt status of the show. When they move upstairs with the "big boys" that type of activity won't wash. (They'll have to learn to do business in the parking lot and hotel suites like everyone else.)

I think we'll see more and more preregistration taking place, as people are fed up with having to wait in line for the better part of a morning or afternoon. Of course, AFIPS will have to do their part by making sure that they get the preregistration form out significantly in advance of the show.

You'll also notice that fewer and fewer companies will continue to use the NCC as the arena for new product announcements. It's just not worth it. Generally speaking, the announcements get lost in the shuffle and the companies can get much better play during the other 11 months of the year.

One thing that NCC will always be is a job hunter's paradise. No where and at no time do so many people armed with resumes congregate in one spot as do the legions of job hunters around NCC. Do these people always put their systems experience to work for them in the quest for better employment? Sometimes I wonder. I spoke with someone who indicated that he would only go to work for a company that had double- or triple-thick carpet in its booth. The reason: those are the companies that really care for their employees. So much for the systems approach.

So next year it's off to Chicago, the first time the show has been held in the midwest for a good number of years. Watch for a record turnout.

Other Editorial Notes

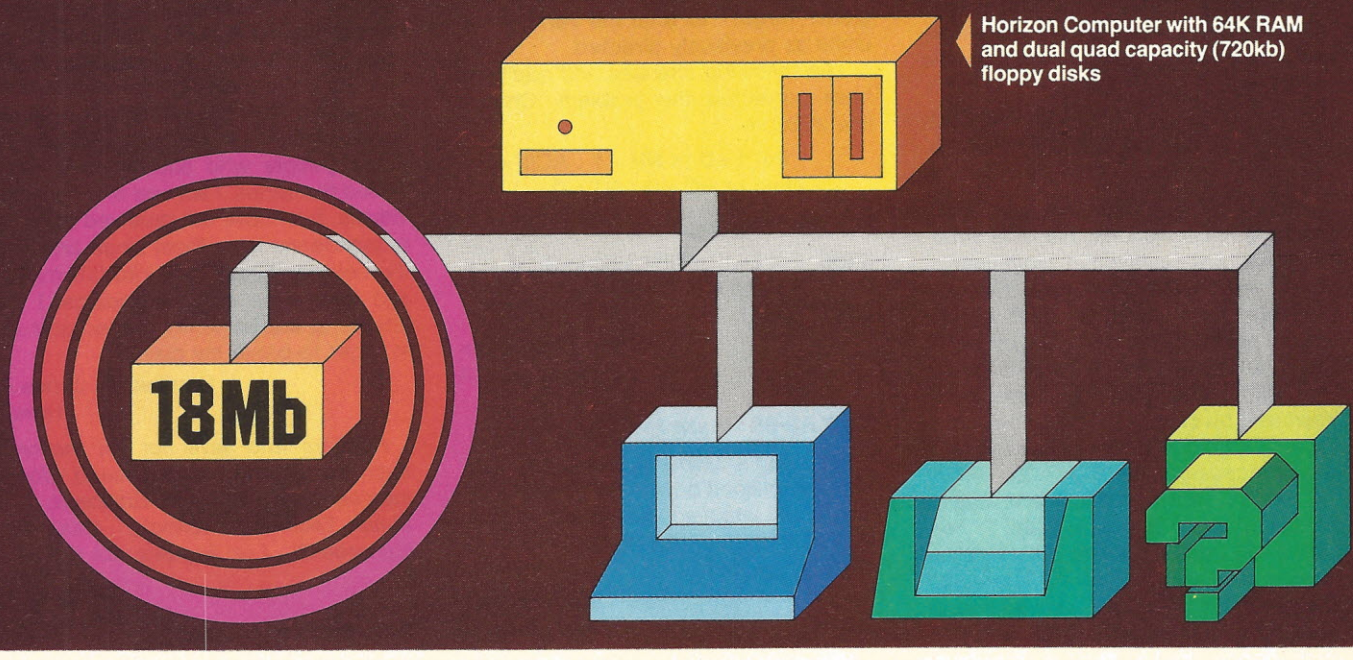
We had to pull the article on security and privacy to make room for the story on the Apple III. It will be rescheduled.

Computerstores, consultants and others with a keen interest for small systems will be interested in a report published by Datapro Research Corp., 1805 Underwood Blvd., Delran, NJ 08075. For $25 they will sell you "All about personal computers," a 62-page professionally produced booklet with individual reports on 15 of the best-selling personal computers. Making the report doubly worthwhile are directories of vendors for small/personal systems, software, peripherals and publications. These fairly comprehensive directories seem to present a clear majority of the firms doing business in today's marketplace. Each listing contains the company name, address, zip code and telephone number.

Systems covered include TRS-80, PET, Apple II, Atari 400 and 800, Compucolor II, Cromemco Z-2, Sorcerer, Heath H8/WH8 and H88/H89, HP 85, Intellivision, Horizon, Challengers I and II and the TI 99/4.

Included is Datapro's version of the history of personal computers and a modest number of market predictions. The report is reprinted from a supplement to the larger "Datapro Reports on Minicomputers" and will probably pay for itself many times over with just the directories. □

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LETTERS

Implementing Snobol

In Chapter 7 of Pascal Notebook, you wrote about Snobol interpreters. Are you aware of any implementation? How much hardware is required? The system may be a little quaint, but it's a lovely—and powerful—language. Keep up the good work.

Dr. W. Bock
Beta Film Gmbh.
Munich, Germany

Since Snobol is intended specifically for string manipulations, the data structures used are designed to simplify algorithms and search/insert time. One unfortunate side effect is that typical Snobol programs tend to be very large. Many implementations require more than 100K bytes just for the interpreter. However, by careful optimization a reasonable Snobol should be possible for a microprocessor system.

The University of Colorado has a Snobol in macro language Stage 2. Fortran is the base language but could be changed to Pascal. If you are interested in higher level languages, minimum hardware should include a CRT terminal, dual floppy disks and a maximum memory machine.

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Gordon S. Wells
York County Board of Education
Box 40
Aurora, Ontario L4G 3H2

Bug Catcher

Phil Roybal's article "Data Base Management for the Apple II" (Mar. 1980) describes the file cabinet program in volume 3 of Apple's contributed software library. I discovered an apparent bug in this otherwise useful program. Your listing helped considerably in correcting it.

The file cabinet program allows the user to format reports in various ways. One option is to be able to total vertical columns of numbers; the report format can then be saved to the disk for later use. Unfortunately, I discovered that when recalled from the disk the program "forgot" to total the vertical columns as previously directed.

The following changes and additions have corrected the problem. Change line 2980 to

```
"For I = 0 to NH + 1 : AC(I) = 0 :
Next I : HC = 0 : GT = 0
```

Add the following lines:

```
3355 For I = I to RH*3 Step 3 : If
     K(I + 2) = 1 Then T9 = 1
3357 Next I
```

Tony Anderson
Fullerton, CA

My TRS-80 Hears Me

Al Baker's Game Corner (IA, Apr. 1980) explained how to make a TRS-80 II hear you when you yelled into it. How do you do this on a TRS-80 I or in machine language?

Steve Hunter
Grant Park, IL

We don't know of any way of listening to the cassette recorder from Level I Basic. It is possible to do it from a machine language program with an editor/assembler. The complete program is too long to list here. The routine is:

```
0010  HEAR   LD   C,255    OUTPUT PORT
0020  HEARL  LD   A,4      SET UP
0030         OUT  (C),A      TO LISTEN
0040         IN   A,(C)    LISTEN
0050         JP   P,HEARL  LOOP IF QUIET
```

Watch Your () and < >

In the program "Attack Command Alpha" (IA April, 1980) line 920 read:

```
920 IF (L)J) AND (L(J + 5) THEN S(I) =
    S(I) + 1 : SH = 2
```

Unfortunately, this line gives a syntax error and any attempt to correct it results in other errors. I would appreciate any assistance.

Judy A. Leyrer
Carrollton, TX

Line 920 should read:

```
920 IF (L>J) and (L<J + 5) Then S(I) =
    S(I) + 1:SH = 2
```

It is often difficult to distinguish between the parentheses () and the greater-than and less-than symbols < > on many printers. Always carefully study any line which gives you a syntax error. Confusing these symbols is a common source of such errors, as is confusing zeros and eights, Z's and 2's, or I's, 1's and T's.

NTS Woes

Last year you published a mini-series tutorial on computer basics of electronics. I participated in the series and had a lot of fun doing so. I did learn from the series, and was very pleased to see somebody trying to educate their readers on this subject. It mentioned in the article that a certificate would be issued by National Technical Schools to those people who satisfactorily completed the series. I am one of those individuals, but I have not received any correspondence from them since finishing the course. Please look into this matter and inform me of your findings. I am enclosing copies of my graded quizzes in order to prove my claim.

Gardiner B. Jones III
Hawaii

Readers who have not yet received their certificates should send documented claims to: Walt Stephens, National Technical Schools, 4000 So. Figueroa St., Los Angeles, CA 90037.

Fortran Fan

I subscribe to all the major computer magazines and each has its virtue. But seldom do I find a series of articles that are as well written, lucid and useful as the series you recently ran entitled: "Using and building micro-based systems."

In fact, the only negative point that I can find with the whole series is the title. It gives the impression of a survey article dealing with specific machines on a general basis. In fact, that title disguises a brilliant tutorial on Fortran programming equalled nowhere else in commonly available literature to small computer users.

Fortran on small micros has the advantage of being a compiler that produces assembly-language modules on execution. Being a Basic related language, much of it a self-taught programmer like me could comprehend and translate quickly and at a very low cost.

I wish to express my appreciation of the article, my admiration for the author's abilities and my thanks to IA for running the series in the face of what must have been mass apathy for Fortran at the time you started this group of articles.

Pete Charlton
Aledo, TX

Question on Link

With reference to the May 1980 IA, we read with interest a reference to 'Link,' a consulting firm specializing in electronic distribution information, and



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would be grateful if you could inform us as to where they can be located.

Richard Davies
London, England

Write to Link at 215 Park Ave. So., New York, NY 10003 or call (212) 473-5600.

Logic Controller Info Sought

We subscribe to IA and regularly require programmer logic controllers of different kinds. Up to now we have purchased Gould and Modison Inc. programmable logic controllers and would like to have the names of other companies making these devices. We would appreciate it if you can have them send us the information directly.

K. M. Mehta
Elecmech Corp.
"Vikas" 11, Bank Steet
Fort, Bombay, India 400023

Assignment Benchmark

We tried the "benchmark" program on a Vector MZ and Soroc 120 using Micropolis Basic. Time to run: 2251 sec.

Paul O. Daignault
Tallahassee, FL

I did your assignment on a 4 MHz North Star Horizon using North Star Basic version 6. Time: 1149 sec.

Bill Richter, Jr.
Victoria, TX

Added a timing routine as follows:

```
10 T1 = TI
265 T2 = TI
270 PRINT "TIME WAS";(T2-TI)/
    60,"SECONDS
```

On a Commodore PET 2001, 32K with Microsoft Basic in ROM the program ran in 1374.22.

Alfred J. Bruey
Jackson, MI

Run time: 1812 sec. using a Processor Technology Sol-20, the Solos operating system and Processor Technology extended cassette Basic.

John M. Kendall
Madison, WI

I am enclosing a few facts about the TRS-80 that you might find interesting.

Timing with Level II exactly as given is 1879 seconds; under DOS Level II Basic under CMD"R" is 2004 sec.; under DOS Level II Basic under CMD"T" is 1931 sec.; best Level II adaptation is 1569 sec.; improved adaptation of listing is 95 sec.

```
 90 DEFINT A-L, N-Z
130 PRINT "STARTING:":PRINT" 1 2 ";
140 FORN = 3TO997STEP2:FORK = 3TO
    31STEP2:M = N/K:L = M
180 IFL = 0THEN230
190 IFL = 1THEN220
210 IFM = LTHEN240
220 NEXT
230 PRINTN;
240 NEXTN
260 PRINT "FINISHED"
```

Incidentally,

```
180 IFINT(M/K) = 0THEN230
```

has a similar effect.

Allan Emert
Odessa, TX

We ran the benchmark program exactly as listed in a Heath H89 and came up with the following results.

Ext. Benton Harbor Basic	3550 sec.
Microsoft Basic 4.7	1850 sec.
Same Mbasic with DEFINT N, K & L	1736 sec.

W.T. Thompson
El Paso, TX

Tom Fox reviews the Heath H8 in this issue.

I just read your benchmark feature and thought it was very interesting.

I thought you might be interested in some results of mine. I have a TRS-80 Model I running under TRSDOS 2.3. When I ran your program as written in the magazine it took 1939 sec. Very close to your figures. I rewrote the program slightly and it then ran in 1548 sec.

I also have accounts on two timesharing systems. One is a Hewlett-Packard 3000 belonging to a local college and the other is The Source which uses Prime computers. Here are the results of running your program:

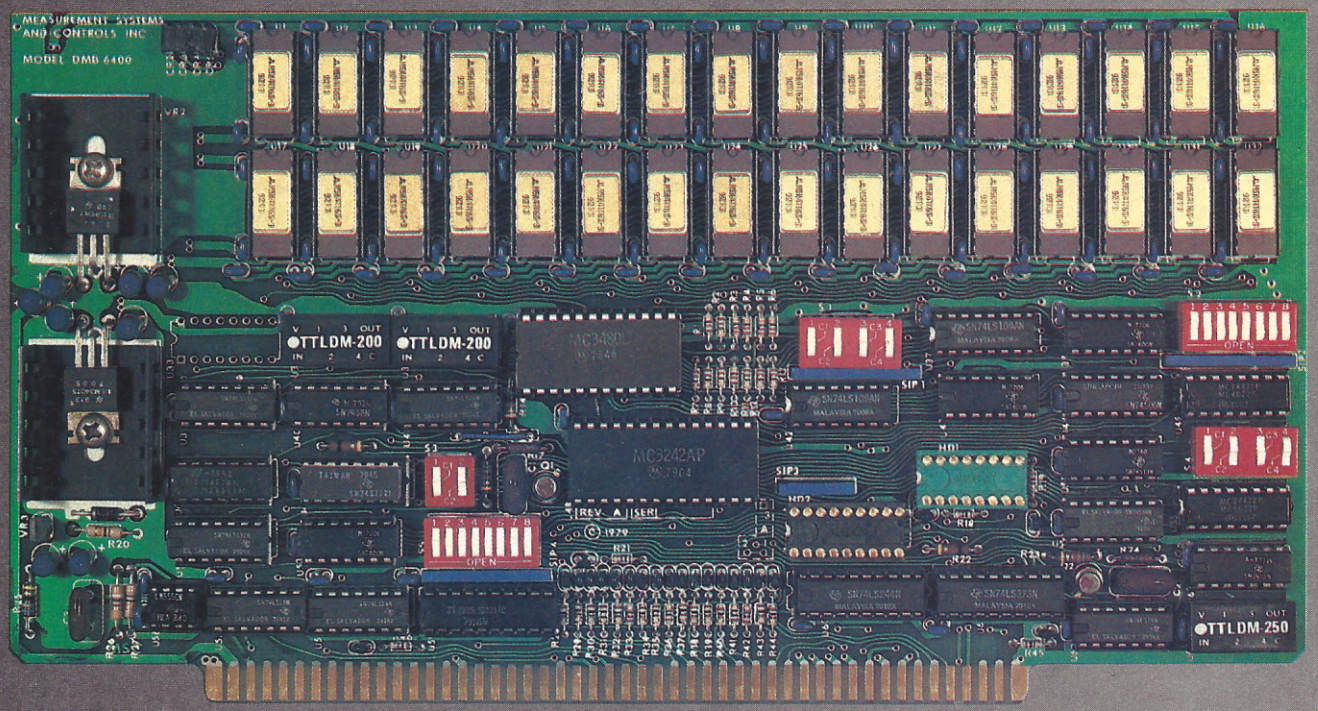
H-P 3000	250 sec.
Prime	25-31 sec. average of about 5 runs

The "Prime" time seemed to be limited only by the 300 baud timeshare rate as it printed out as fast as the 300 baud rate would allow from beginning to end with no pause in the printing for calculation as the H-P 3000 did.

Donald A. Wheeler
Takoma Park, MD

I read with interest your benchmark tests. A very simple and humbling demonstration of the power of my pride and joy Cromemco Z80A processor.

My benchmark time for your program for prime crunching was repeatable at 1116 sec. Oh well, not as good as the



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best, but much better than the Zilog MCZ-1/70.

My operating system was Cromemco's CDOS (very much like CPM) and the language was Cromemco's Extended Basic.

I then followed your suggestion to experiment with other methods not for benchmarking but to find a more efficient method of doing your problem. The program below is the final result.

To find primes within any span of odd numbers simply replace the limits in line 60 with the number range (beginning with an odd number) in question. Be sure to remove line 40.

Also, even though I had my Z80A running in the 4 MHz mode, I found a significant difference in running times if I set my Soroc terminal at 110 baud or 19200 baud.

My algorithm ran at 55 sec. as compared to 1116 sec. for your benchmark program. Both of these measurements were made at a communication rate of 19200 baud, and my algorithm took 74 sec. when I set my communication rate to 110 baud.

The point of this is that benchmarking programs are influenced by your I/O configuration as well as the power of the processor.

```
 10 REM PRIME NO. GENERATOR
    BY G. W. SMITH, JR.
 30 @"Start:"
 40 @"123";
 60 FOR I = 5 TO 1000 STEP 2
 80 FOR D = 3 TO INT(SQR(I))STEP 2
 90 IF FRA(I/D) = 0 THEN 120
100 NEXT D
110 @I;
120 NEXT I
130 @CHR$(7)
140 @"Finished."
150 END
```

George W. Smith, Jr.
Naperville, IL

Here are my results. I used an SWTPC 6800 kit with Software Dynamics 6800 Basic compiler ver 1.2. The benchmark run time was 528 sec.

Here is my program:

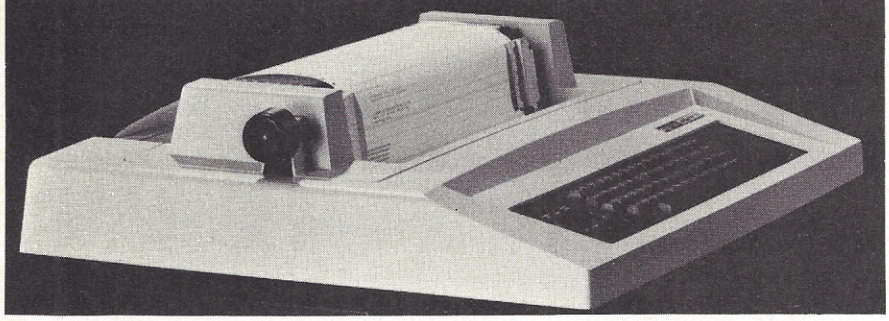
```
100 REM Interface Age's benchmark
110 REM program to 'discover' the
120 REM first 1000 prime numbers
DIM K,L,M,N
DIM BELL$/:7/
130 PRINT "Starting"
140 FOR N = 1 TO 1000
150 FOR K = 2 TO 500
160 LET M = N/K
170 LET L = INT(M)
180 IF L = 0 THEN 230
190 IF L = 1 THEN 220
200 IF M>L THEN 220
210 IF M = L THEN 240
220 NEXT K
230 PRINT N;
240 NEXT N
250 PRINT BELL$
260 PRINT "Finished"
STOP
END
```

Gene Embry
Morrisville, NC

I really appreciate articles like *Assignment: Benchmark*. This kind of careful comparison of system performance is invaluable in hardware selection.

I must take issue, however, with part of the evaluation philosophy. What is being evaluated is a combination of a processor and an interpreter. Neither functions without the other; the way they work together is crucial to system performance. For example, an interpreter written for an 8080 running on a Z80

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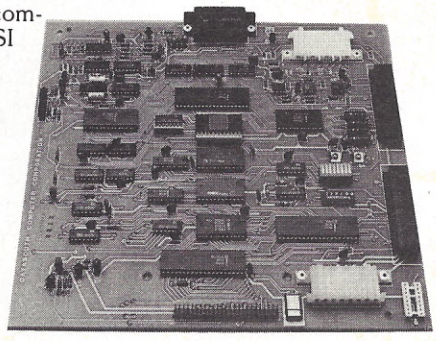


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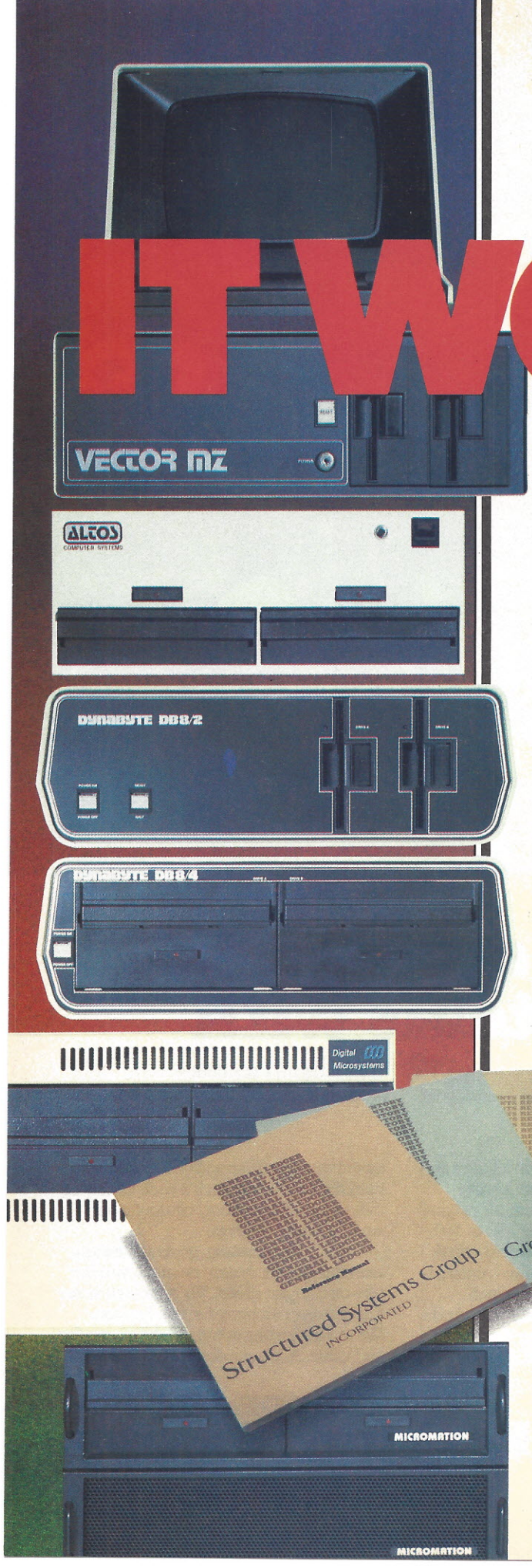
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processor will not take advantage of expanded facilities of the more modern processor chip. If the design of the interpreter wasn't so critical to total performance, we wouldn't see the nearly 2:1 timing ratio between the Radio Shack Model II and the Zilog MCZ-1/70, both with the same CPU and clock speed.

An important part of our test is the cleverness of the authors of the interpreter. The elimination of unusual features (like the ability of Ohio Scientific's Basic to 'goto y') destroys much of what we want to test.

I fully support the intent to eliminate as a benchmark factor the cleverness of the application programmer implementing the algorithm, but trying to eliminate the cleverness of the interpreter just isn't fair.

It is correct that this algorithm doesn't do a very efficient job of computing prime numbers. In case readers need to compute prime numbers, I have included a listing for a much more efficient method. The program runs in less than 23 seconds on a TRS-80 Model II, an improvement factor of more than 40:1.

```
100 CLS
110 DEFINT A-Z
120 DIM A(2000)
130 A(1) = 3
140 Z = 1
150 FOR M = 5 TO 1000 STEP 2
160 DOE J = 1 TO Z
170 IF M MOD A(J) = 0 THEN 230
180 IF M<A(J) * A(J) THEN 200
190 NEXT J
200 Z = Z + 1
210 A(Z) = M
220 PRINT M;
230 NEXT M
240 END
```

Two factors account for the significant improvement. 1) When testing to determine if a number is prime, only prime numbers need be used. For example, if a number is not divisible by 5, it won't be divisible by 15. 2) When testing by smaller prime numbers, you can quit after dividing by the largest prime greater than or equal to the square root of the number being tested. For each factor of a number less than or equal to the square root, there is another greater than or equal to the square root. If you haven't found a prime factor by the time you reach the square root, there aren't any.

Robert F. Snapp
Cincinnati, OH

Entered and ran the "Prime Number Cruncher" program on my Texas Instruments 99/4.

Two successive runs took 2479 seconds total. A dubious record at best, considering the highest time shown in your article was 1928 sec.

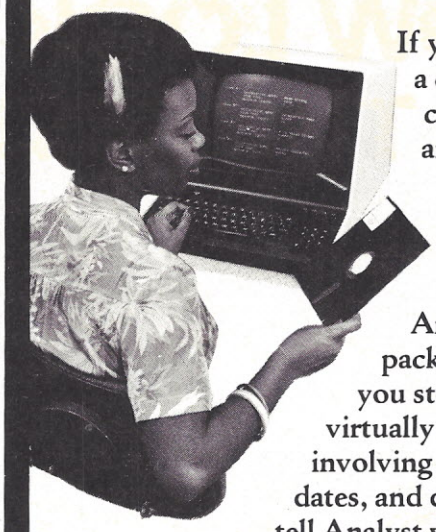
Evans M. Harrell
Marietta, GA

It was with great interest that I read the *Assignment: Benchmark* article. Some comments:

One benchmark program doesn't really tell much of the story. Several programs are needed.

Your table did not indicate whether the Basics were compilers or interpreters but I suspect that nearly all of the entries were interpreters, as compilers generate code which runs much faster.

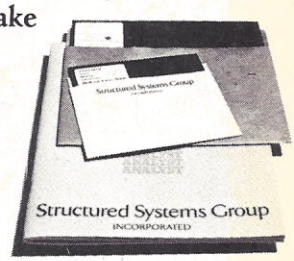
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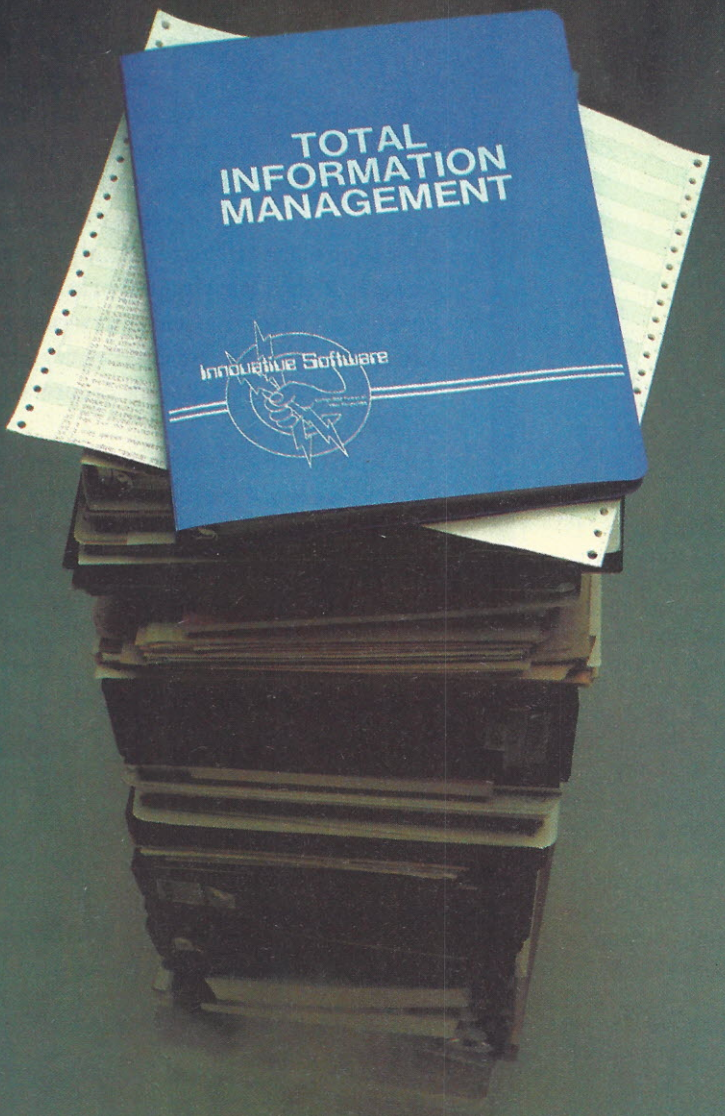
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CIRCLE INQUIRY NO. 26

The "prime number cruncher" program was dismal. The code was practically uncommented, totally obscure and mostly unstructured.

I found the first paragraph particularly obnoxious.

For the record, I wrote prime number finding code in a high level language (C) using a well known and efficient algorithm (sieve of Eratosthenes). The average execution time of 10 runs was 4.0 seconds using a Heath H8 with a 9600 baud ADM-3A terminal.

I also programmed Kludge in Microsoft Fortran, the execution time was 470 seconds on the same H8.

Given this issue is billed "business computing," how could you leave out CBasic?

Ray F. Cherry
Columbia, MD

I'm a novice who's had a Compucolor II, Model 4 since September 1979. My background is in manufacturing operations management, and not computers. I bought my computer for business/home applications. My only education in computers has been through Compucolor's programming manual and through articles such as yours.

Assignment: Benchmark intrigued me because I noticed ISC's Compucolor 8051 is positioned midway between the two TRS-80s. I decided to pit my CC-II against the list, expecting my results to be identical to the Compucolor 8051.

My results stopwatch out at 1,267 sec. running your listing.

Keep up the excellent articles on systems.

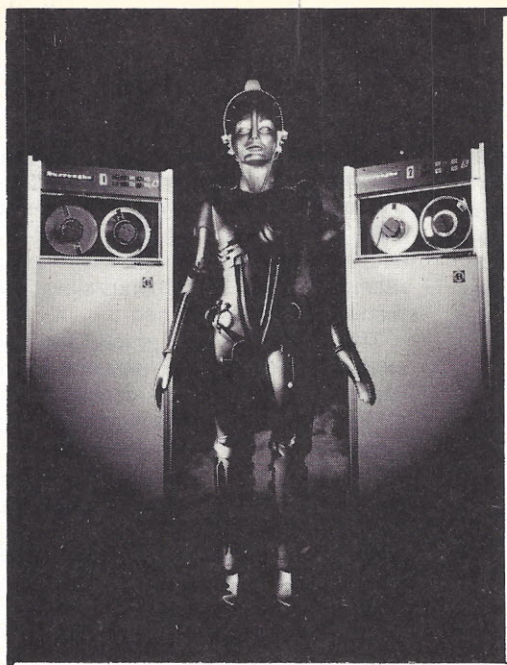
Sidney Segawa
Chatsworth, CA

I decided to code the benchmark algorithm in Pascal and run it on my Western Digital "Microengine." The execution time was 14 sec.

I next modified the algorithm to eliminate the checking for even numbers and to estimate the largest divisor that needs to be checked, using the well known algorithm for extracting a square root. With these changes the microengine calculated the primes from 5 to 997 in an elapsed time of 2.8 sec. If the print statement is removed, the execution is but 0.8 sec.

Philip F. Meads
Oakland, CA

I tried the program from the article *Assignment: Benchmark* on my Exidy Sorcerer. The program was entered exactly as written. It took 1260 sec. to



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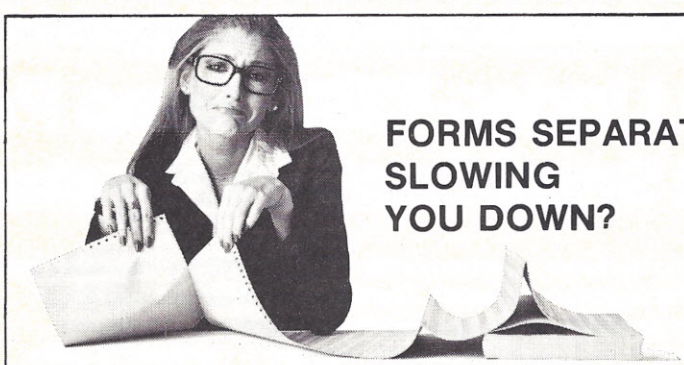
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CIRCLE INQUIRY NO. 59

execute. I then added some indentation, using the colons required by 8K Microsoft Basic. This increased the time by 11% to 1405 sec. Moral: There is a price to be paid for more legible listings.

Carroll M. Grigsby
Raleigh, NC

We are using a Cromemco System Three and an Apple II Plus in our software development lab. Here are the results of running your benchmark using various Basics on these systems: Cromemco CS-3 with CDOS and CBasic-2 ran in 2445 sec.; with 32KBasic ran in 1074 sec.; Apple II Plus with DOS3.2 and Applesoft 2 ran in 980 sec.

Just for fun, we translated your benchmark program into Fortran IV and ran it through the Cromemco compiler on our CS-3. It ran in 233 sec.

Christine Bell
Boston, MA

I ran your prime number cruncher on my Vector Graphic MZ. It has an MDOS operating system and uses Micropolis Basic v 8.5. Running time for your program was 2261 sec.

You challenged one to improve time without changing the algorithm. I did not try to do that; however, I wondered what improvement in time could be accomplished by using another algorithm. So I tried Eratosthenes sieve; the running time was 999 sec.

Thank you for the article and the exercise. Despite the adverse comments you quote from computer experts, I now know a little more about my computer and the language it uses.

Richard Hamburger
Germantown, MD

Here are two interesting benchmark results. The program was used as written.

Case 1, a Processor Technology Sol-20 using the Solos o/s and Altair Basic (8K): 1231 sec.

Case 2 was run on a large time-sharing system using a CDC Cyber 174-12. Sol is hooked up via acoustic coupler at 300 baud. Listing time: 47 sec. CPU time: 14 sec.

It looks as though we still have a way to go before we catch up with those big mainframes.

Len Kalish
Los Angeles, CA

Bugged Micro Roots?

I entered the Micro/Roots programs (IA, Jan 80) into an SWTPC 6809 computer with 56K RAM. These programs were just what I had been looking for as I am learning Basic and starting a genealogy project.

I made some minor changes to accommodate TSC's extended Basic. Has anyone reported any bugs that may have crept into the software?

I have run into a few problems but have yet to decide if it is the program or me. Should you or anyone else discover any bugs, I would appreciate hearing about them.

Jim Harpel
952 Flair Court
Creve Coeur, MO 63141

No bugs reported.

Reader Help Requested

As an avid reader of IA I have obtained a great amount of information on a wide variety of computer related topics. It is in search of more information that I am writing.

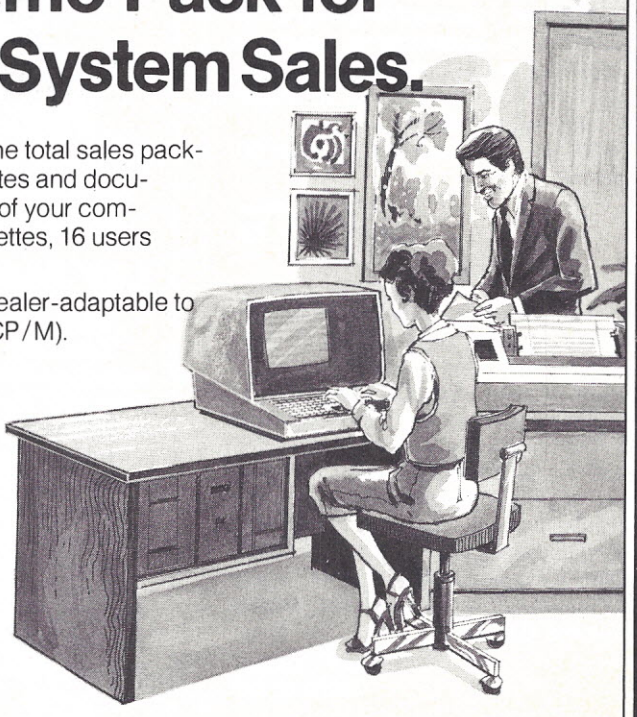
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CIRCLE INQUIRY NO. 28

microprocessor development systems that we currently are using. These include the Tektronix 8001, the Intel MDS and the Motorola MDS. We currently have a National Bureau of Standards cross assembler in use but its continued use is beginning to show major flaws in its design and ease of use.

All I can ask of you is to have your readers send me information detailing any universal assemblers they may know are available. Our main concern is to find such an assembler that can handle a wide range of microprocessor languages and if possible produce some sort of relocatable object modules. Any information will be greatly appreciated.

Jerry B. Scott
3939 Fabian Way (V-03)
Palo Alto, CA 94303

Here's Looking at Business Systems

I read with interest the article by Tom Fox "Looking at Micro-Based Business Systems" (Jun 1980). The article gives a good overview. However, I must take exception to one pont: ". . .The tremendous base of retail outlets was solely responsible for making a mediocre product—the original TRS-80—the most widely produced computer in history. Well in excess of 100,000 have been shipped. . ."

How could anyone sell over 150,000 of *anything* if the item in question does not have something going for it, regardless of how many stores sell the item. In fact, the success of the product was achieved in spite of the stores not because of them, due to the nature of the machine itself and its capabilities.

I have owned a TRS-80 Model I for over a year, using it in a business environment. Try a TRS-80. You just might find that it has some things to offer that your $10,000 system cannot—for less than $3,000.

Charles A. Reeves, Jr.
Knoxville, TN

It's about time an article summarizing so many manufacturers' systems is easily available to the small businessman. As stated in the article, it's almost impossible to have the latest information when comparing 30 different systems. Here are some of the latest improvements in the Ohio Scientific C3 series computers.

All systems shipped in the last six months operate at a 2 MHz clock speed as opposed to the 1 MHz speed of earlier systems. This makes the C3 the fastest of the 8-bit computers in your benchmark test. This timesharing mode supports 16 users. A 74 megabyte hard disk is available in addition to the 23 megabyte disk. All systems include Microsoft extended disk Basic.

One valuable addition to users is that many dealers offer complete hardware and software support.

Lee Kupersmith
Eastchester, NY

Info on Idol Wanted

We would like more information on Idol, written by DTI of Riverdale, MD. This was mentioned in the March System of the Month article by Tom Fox.

Henry Keultjes
Mansfield, OH

We consulted with Tom Fox on the Idol program and he suggested contacting John Reilich of Rexon Corp. in Culver City, CA, (213) 641-7110.

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You can buy my TRS-80 systems all over the country—dozens of companies sell them. Some are my dealers, some aren't. And this creates a new set of problems.

You see, learning to use a computer—any computer—is like learning anything else. It takes some getting used to. If you sit down with a computer program and the manual and try to figure it out all by yourself, you'll probably just give up and feel you've been had.

You have to hang in there for a month, make a few phone calls, and have somebody who really understands the system help you work it out.

That's why I still answer the phone. And why, I guess, people say all those nice things.

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CIRCLE INQUIRY NO. 63

Users Vocal About CRT Terminal Size

Users of alphanumeric CRT terminals express a strong preference for 80-column by 24-row displays. The 1,920 character display will continue to be the de facto standard. According to a study by Venture Development Corp., users overwhelmingly prefer the 80-column display, which has become standardized to the point where only 5% prefer displays with fewer columns and only 9% have a requirement for more than 80.

The 132-column display has not gained the popularity manufacturers had hoped. IBM, DEC, Datamedia, Datagraphix and others all offer CRT terminals with 132 columns, and VDC expects other manufacturers to follow.

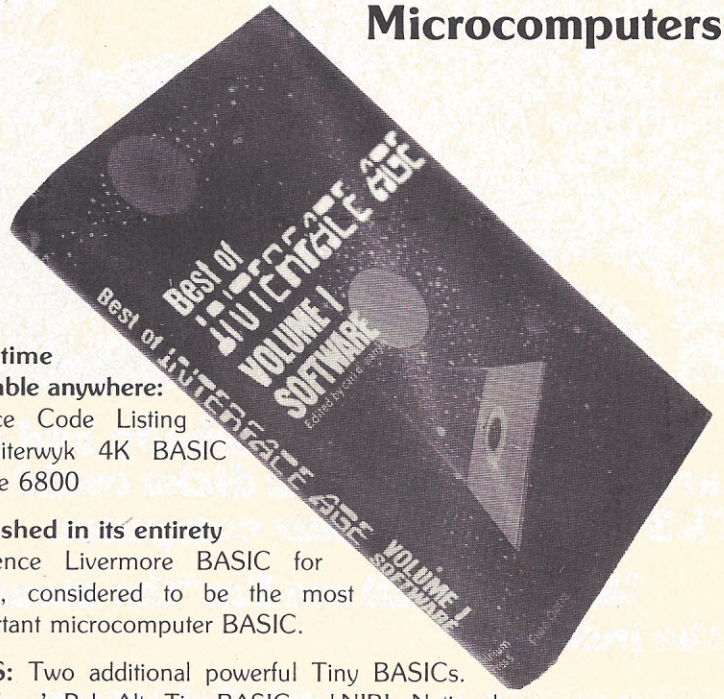
Although the 132-column display has applications in selected areas, most users are not willing to pay the increased price for a feature which they feel has only marginal value. Dedicated applications, such as data entry, inquiry/response or order entry, do not require 132-character displays, and users will not pay the additional premium to get them. "My money is better spent on other features, not on smaller, distorted characters," quipped one user.

Users did, however, express a desire for more total characters per display but felt this should be done through additional rows, not more columns. A 25th row is highly desirable, as are addition rows, for word processing applications. The 25th row which has been gaining wider acceptance, is used primarily for monitoring system status and control rather than for display of data.

Users expect the "standard" CRT terminal for information display applications to remain a 24-row, 80-column, 1,920-character unit for the next several years. The addition of the 25th line is expected and will be accepted, particularly by those who want to monitor their systems at the terminal.

Further information regarding this report can be obtained from Edward A. Ross, Senior Consultant, Venture Development Corp., One Washington St., Wellesley, MA 02181, (617) 237-5080.

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DP Firms Expect Banner Year

The computer industry, enjoying an annual growth rate of close to 15% the past quarter century, is heading for another record year according to the advisory service Value Line. High backlogs and strong order rates indicate companies will post earnings up about 12% this year; however, it warns that a really severe economic downslide could impede 1980 growth.

Most computer firms reportedly have more business booked than they can deliver in normal lead times, offering better than ordinary business stability during the difficult coming months.

Recent computer price rises may not halt the industry's sales progress, Value Line believes, because the price performance of computing equipment is improving rapidly. It is possible these improvements will continue to justify more than enough sales to counter deferrals by some prospective users.

The analyst predicts that the industry will earn about $5.35 billion, up from approximately $4.75 billion last year. It estimates 1980 sales at $52 billion compared to about $45.5 billion in 1979. Industry earnings should surge to about $8.2 billion within the next three to five years.

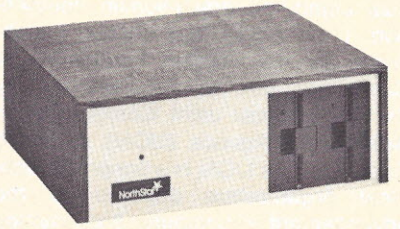
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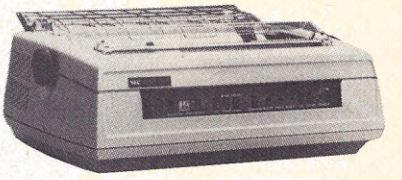
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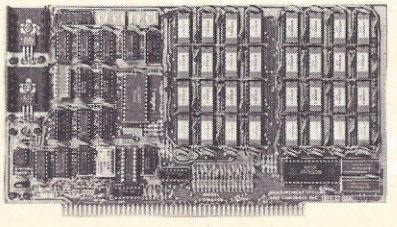
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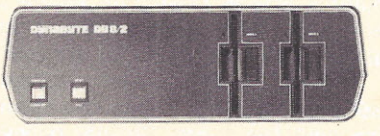
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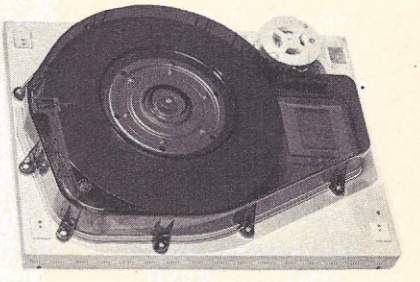
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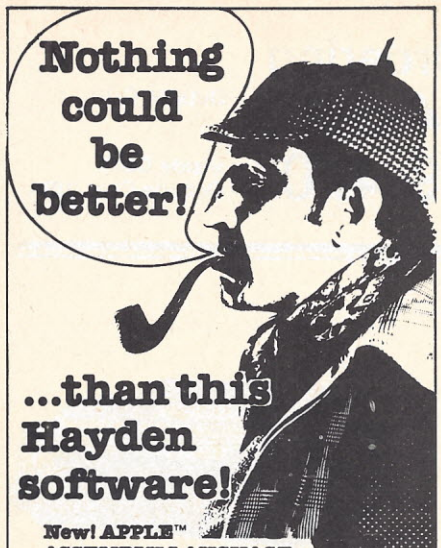
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CIRCLE INQUIRY NO. 23

$100,000 Prize for Computer Chess Champion

Carnegie-Mellon University established a $100,000 prize for the first computer program to become world chess champion, thus beginning an annual computer-versus-human competition. The Fredkin Prize contest, established by the Fredkin Foundation of Cambridge, MA, will be monitored by the International Joint Conference on Artificial Intelligence (IJCAI) of Menlo Park, CA. The IJCAI is a nonprofit technical organization devoted to the advancement of computer construction aimed at achieving intelligent action by computers.

Dr. Hands Berliner of the CMU computer science department, himself a former world correspondence chess champion and author of the computer backgammon program that last year defeated the World Backgammon Champion in Monte Carlo, heads a committee that will formulate precise rules under which the competition will be held. "We want to insure that any human competitor playing against a computer has the right to place a qualified observer at some point to guarantee that the computer is actually making the moves and not a group of consulting chess experts at the end of the wire," he explains.

There is no chance that a computer will become world chess champion in the next five years, Berliner believes. "It will take more than five years and probably much longer," he says. "By 1990, I think there is a 50-50 chance that it will happen. From that point, the odds gradually get better and 20 years from now it is almost a certainty."

Winning the championship is a four year process for a human; the computer will also have to work its way up the ladder in tournament play. "Even getting to the first rung is three or four years away," Berliner continues, "but I think a computer will be playing in the U.S. Invitational Championship within the next five years."

In the interim, a set of incentive prizes will be offered each year for computer-versus-human competition. "Two human players of a specified skill level will be selected randomly from among chess players at that level," Berliner explains. "These players will engage the best and second-best computer programs as determined by that year's competition. Each contest will consist of a pair of games with the players, human or machine, with the best score in the two games receiving the prize. In case of a tie, the prize money will be split evenly."

In each succeeding year, the skill level of the human players will be increased as will the amount of the prize. The first competition will be held this November at CMU and the prizes will be $1,500 and $1,000 respectively.

DP Buyer Service Formed

The Association of Computer Users of Boulder, CO, has started a reference service that allows buyers of data processing equipment to get specific information about registered products through discussion with current users of the hardware or software.

A supplier registers one or more of its products with the association and provides at least 10 current users who agree to answer questions from potential buyers. A buyer wanting specific information simply contacts ACU by mail or phone, gets a list of references for the product, and contacts them directly.

ACU does not test or rate products. Its purpose is only to open direct communication between users and buyers regarding hardware and software now on the market.

The companies who register with ACU believe in the quality of their products, and know it's to their advantage to supply potential customers with as much useful information as possible.

Multi-Million Dollar Damage Suit Filed

Atari of Sunnyvale, CA, has filed a $20 million suit in San Francisco federal court against Activision, Inc. and four of its principal employees for trademark infringement, unfair competition and a conspiracy to expropriate trade secrets.

The individuals are former Atari employees responsible for creating the software or game cartridges. According to the complaint, the employees left Atari after conspiring to take confidential trade secrets used to create game cartridges for video computers.

The suit claims: "the speed with which the defendants were able to design, manufacture and market cartridges adapted to extremely complex programming needs. . .is so remarkable as to have been virtually impossible without the wrongful use of trade secrets. . ."

Damages sought consist of the profits which Atari allegedly will lose, as well as the value of the research and development costs which Activision ex-

propriated through its allegedly wrongful conduct.

National Computer Association Formed

The proliferation of computing products and associated applications has made it impossible to gain information about all the available products, according to Floyd L. Burton, director of the newly-formed National Computer Association. Since system houses as well as end users need to communicate about such products through some central organization, NCA proposes to fill this reported need by providing a quarterly publication to promote the exchange of ideas, an indexed catalog of products available from other members and a forum for the presentation of information and exhibits in an annual meeting. Annual membership is $35 from the fledgling group at 1485 E. Fremont Circle South, Littleton, CO 80122.

Reprieve for Interact Computer Owners

If you or your friends/associates/customers purchased an Interact home computer, they have discovered that Interact Electronics no longer answers its phones. It closed doors in Dec 1979 when it "just ran out of money."

But their computer investments are secure. Replacement tapes, parts, service, and newer software such as Backgammon, Volleyball, Touchdown, and financial tapes are available from Micro Video, Ann Arbor, MI. New titles, including Football, Ezedit, Thinkcards, and Hammurabi have just been released.

An active user's group with 150+ members and a newsletter has also formed. It's working on printer/modem (RS232) interface kits, memory expansion, machine language programming, USR functions, and more. A modest $10/year membership fee is required to get its technical/programming information.

Micro Video bought a substantial part of Interact's secured inventory from the bank, permitting owners continued use of their Interact units.

General Datacomm Opens UK Operation

General Datacomm Industries Inc. reports that it has established a subsidiary in England.

The new subsidiary, General Datacomm (UK) Ltd., will design, manufacture and market equipment in the UK.

General Datacomm designs, assembles and installs data communications networks and equipment for industrial, commercial and service corporations, government agencies and common carriers. Approximately one-third of its 1979 sales were outside the U.S.

Japanese Dump Computers in U.S.

Asian electronics companies, already well positioned in worldwide consumer electronics and semiconductor markets, are now gearing up to establish themselves strongly in computers, according to industry sources. 1980 will see the Japanese intensify their efforts to export computers, with the United States their biggest market.

The Japanese plan to sell an estimated $1.66 billion worth of computers in the U.S.—some 15 to 20% of their total production, and 60% of total exports. While 70% of current exports are in peripherals, the new export strategy will see Japanese companies competing to sell complete systems under their own brand names.

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AL BAKER'S GAME CORNER

We are going to play a new kind of game. The Atari computer is going to be our window on the universe. It is ideal for school teachers and the children among us who like to experiment with new toys. I am one of those children. Orbits has given me many hours of fun. Others should find it equally thought-provoking and enjoyable.

The listing is hard to understand, especially lines 100 through 280, but don't try to understand it yet. First, let's think about how the universe works and play with the program.

Orbits converts a video screen into a picture of open space. Two or more objects are placed on the screen. Each is given a gravity—how strong it pulls every other object on the screen. The objects are also given initial velocities. This determines how fast and in what direction they are moving.

Type in the program and run it. (See example 1.) When it asks for the number of objects, type 4. Tell the program that the first object has a gravity of 100, an X-coordinate of 80, a Y-coordinate of 40, an X-speed of 0 and a Y-speed of 0. Enter the correct numbers for the other three objects in the example.

Your screen is now a window looking down on a solar system containing a central star with three orbiting planets. The planet closest to the star is orbiting the star quite rapidly; the farthest planet is orbiting very slowly.

Try the other two examples, or make one up. Example 2 is a solar system containing one star, a single planet orbiting the star, and one moon orbiting the planet. Example 3 is a solar system composed of two stars orbiting each other. Far away, a single planet is orbiting both. Try creating a three star system or getting two moons to orbit the planet in example 2.

Warning: if the objects fall too close to each other, gravitational whiplash will sling them apart at high velocity. The heavy object will slow up a little, or speed up in one direction as the other object shoots off at high speed in another direction.

The program really begins above line 1000. Most of it is self explanatory. Each object on the screen has five attributes: gravity, horizontal position, vertical position, horizontal velocity, and vertical velocity. The program divides the velocities by 100. This keeps all the numbers typed in about the same size. A velocity of 100 means that the object moves one position on the screen each clock tick.

Line 1360 creates a trap. This tells the computer to go to line 100 if the program tries to move an object off the screen. Otherwise, we would get an error message.

The meat of the program runs from lines 130 to 280. There are no comments here, as they slow down the program. Lines 130 and 280 form a loop. On most computers, this is faster than a loop using a 'goto.' Line 140 keeps the screen from changing colors after eight minutes. Lines 150 to 190 compute the acceleration on each object. Remember that V(I) and U(I) are an object's velocities. An acceleration is nothing more than a change in velocity. These lines make the necessary changes to V(I) and U(I) for each object based on the gravitational pull of every other object. Line 170 does all the work.

Lines 200 through 270 move the objects. First, the program uses color register 4 to turn off the dots on the screen at subroutine 110. Then it uses the velocities to move the objects. Finally, color register 1 is used to redraw the objects.

If the program ever tries to draw the object off the screen, the trap on line 1360 is activated. Line 100 reinitializes the trap and jumps to line 120. Since the trap is caused by the 'plot' statement in line 110, this effectively ignores the plotting of objects when they aren't on the screen. As soon as they move back onto the screen, they show up again.

Orbits is a model of the law of universal gravitation. Galileo would have loved to have this program running on his Atari. If physics makes your knees wobble, skip this section; the program will still work.

In diagram 1, we determine what the gravitational pull of object J does to the velocity of object I.

G(J) is the pull of object J on another object one unit away, but object I is D units away. Therefore the pull is $G(J)/D^2$. This is the inverse square law. Gravitational pull decreases as the square of the distance from the object. Since D is the square root of $X^2 + Y^2$ then $D^2 = X^2 + Y^2$. This is the variable D2 in the program. This gives an actual gravitational pull of G = G(J)/D2.

Orbits is a model of the law of universal gravitation. Galileo would have loved to have this program running on his Atari.

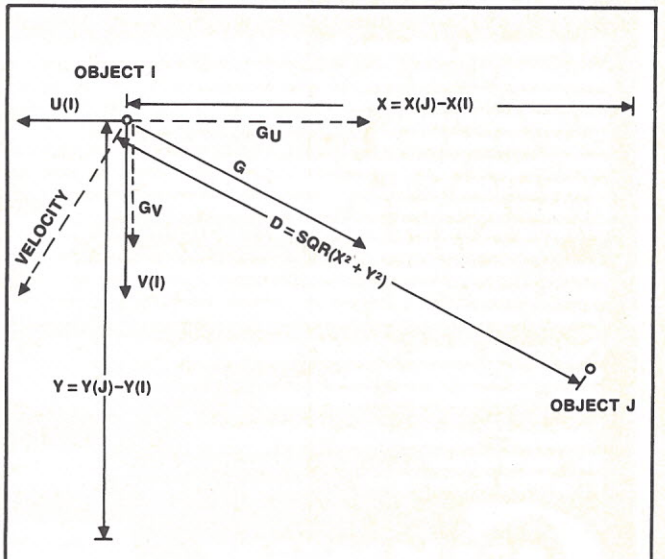
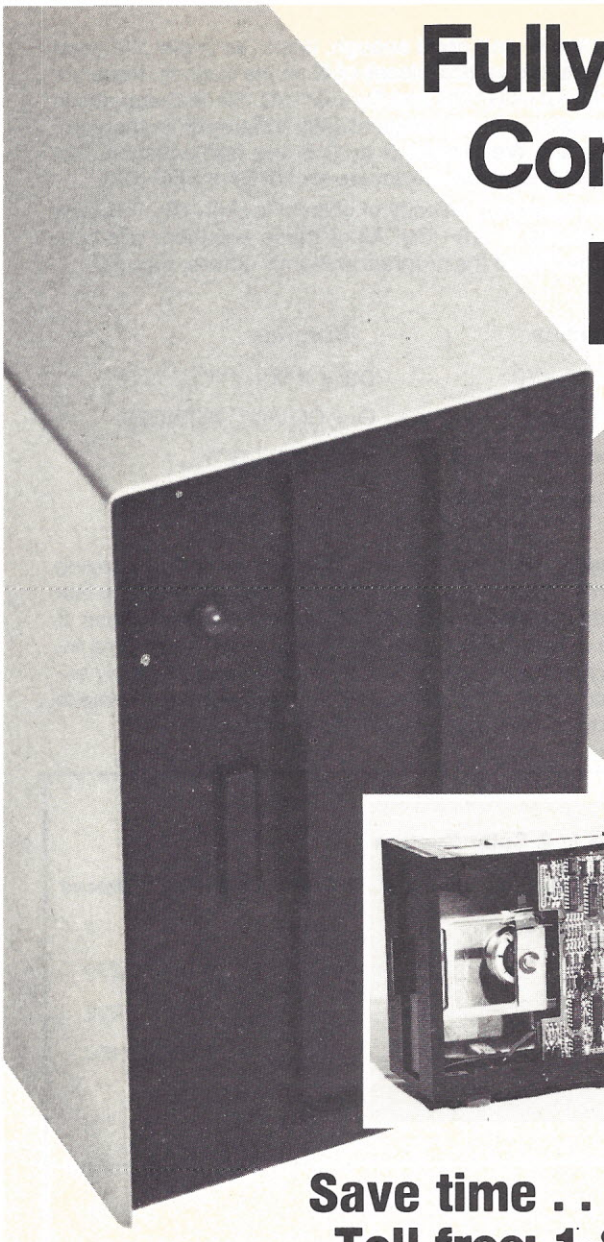


Figure 1. Study of gravitational pull of object J to object I.

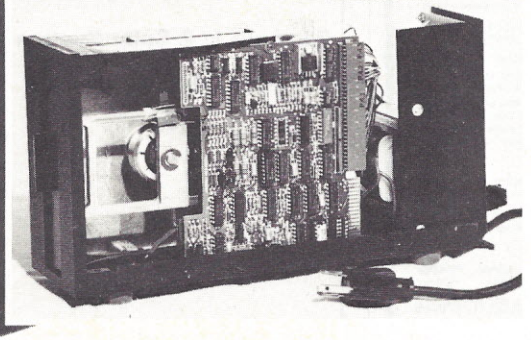
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But getting G isn't good enough; it is at an angle. We need the horizontal and vertical pieces of G. In the diagram, these are G_V and G_U. $G_U = G*X/D$ and $G_V = G*Y/D$. Since D appears in both equations, we did things slightly differently in the computer program. We divided G by D in the first equation. Remember that D is simply the square root of D^2 or SQR (D2).

The new horizontal velocity of object I is $U(I) + G_U$. The new vertical velocity is $V(I) + G_V$. All of these equations are contained in line 170 of the program in slightly different forms:

Physics	Program
$D^2 = X^2 + Y2$	D2 = X*X + Y*Y
$G = G(J)/D^2$	G = G(J)/(D2*SQR(D2))
$V(I) = V(I) + G*Y/D$	V(I) = V(I) + G*Y
$U(I) = U(I) + G*X/D$	U(I) = U(I) + G*X

I like using the computer as a toy even more than playing games on it. It's just like a construction set or chemistry lab, except you can't lose any parts and it doesn't make a mess. If you have created a program that does mean something interesting just for the fun of it, let me know, including any examples for Orbits. The fastest way to get a message to me is on The Source, ID TCB948, or write me at IA. ☐

Example 1: A Solar System

4 Objects	Gravity	X-Coord	Y-Coord	X-Speed	Y-Speed
1	100	80	40	0	0
2	1	70	40	0	250
3	1	60	40	0	200
4	1	50	40	0	150

Example 2: Star, planet, moon

3 Objects	Gravity	X-Coord	Y-Coord	X-Speed	Y-Speed
1	100	80	40	15	-30
2	30	30	40	15	120
3	.1	30	35	-185	120

Example 3: Binary Star System with Orbiting Planet

3 Objects	Gravity	X-Coord	Y-Coord	X-Speed	Y-Speed
1	100	70	40	0	75
2	50	90	40	0	-175
3	1	80	10	-250	0

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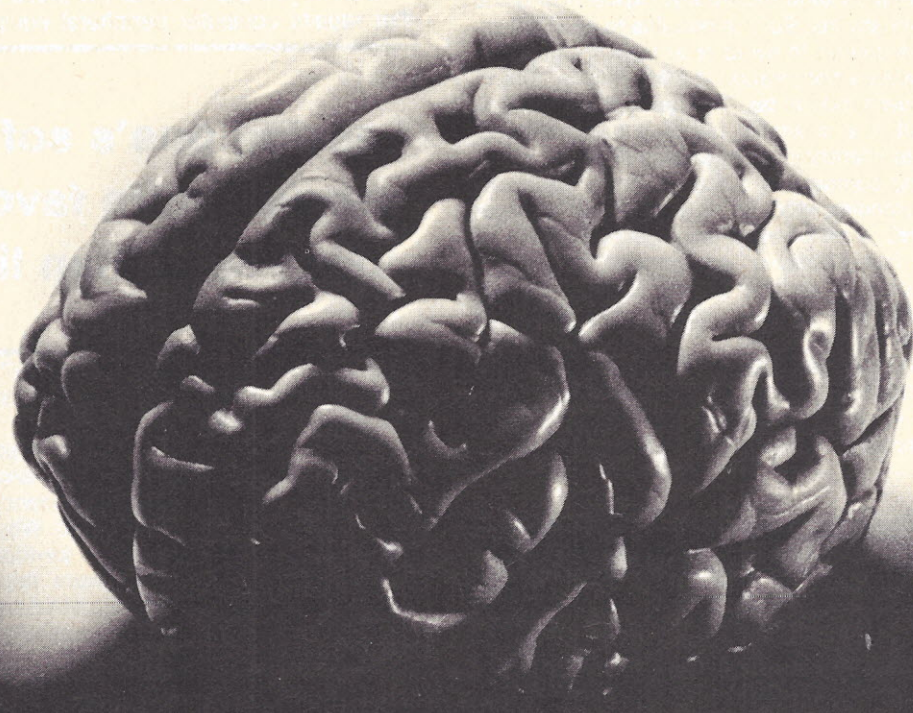
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PROGRAM LISTING

```
10 REM ... ORBITS ...
20 REM
30 REM
40 REM GO SET UP THE 'GAME'
50 REM
60 GOTO 1000
70 REM
80 REM THE TIGHT DISPLAY LOOP
90 REM
100 TRAP 100:GOTO 120
110 PLOT X(I),Y(I)
120 RETURN
130 FOR EVER=1 TO 1 STEP 0
140 POKE 77,0
150 FOR I=1 TO T
160 FOR J=1 TO T
170 IF I<>J THEN X=X(J)-X(I):Y=Y(J)-Y(I)
:D2=X*X+Y*Y:G=G(J)/(D2*SQR(D2)):U(I)=U(I
)+G*X:V(I)=V(I)+G*Y
180 NEXT J
190 NEXT I
200 FOR I=1 TO T
210 COLOR 4
220 GOSUB 110
230 Y(I)=Y(I)+V(I)
240 X(I)=X(I)+U(I)
250 COLOR 1
260 GOSUB 110
270 NEXT I
280 NEXT EVER
1000 REM
1010 REM SET UP GAME
1020 REM GET NUMBER OF OBJECTS
1030 REM
1040 PRINT "NUMBER OF ORBITING OBJECTS";
1050 INPUT T
1060 REM
1070 REM NOW SET UP MEMORY
1080 REM
1090 REM I = CURRENT OBJECT
1100 REM T = TOTAL OBJECTS
1110 REM G = PULL BETWEEN OBJECT I & J
1120 REM
1130 REM G(I)= GRAVITATIONAL PULL
1140 REM X(I)= HORIZONTAL POSITION
1150 REM Y(I)= VERTICAL POSITION
1160 REM U(I)= HORIZONTAL VELOCITY
1170 REM V(I)= VERTICAL VELOCITY
1180 REM
1190 DIM G(T),X(T),Y(T),U(T),V(T)
1200 REM
1210 REM GET VALUES FOR ALL OBJECTS
1220 REM
1230 FOR I=1 TO T
1240 PRINT "FOR ORBITING OBJECT ";I
1250 PRINT "GRAVITY=";:INPUT A:G(I)=A
1260 PRINT "X-COORD=";:INPUT A:X(I)=A
1270 PRINT "Y-COORD=";:INPUT A:Y(I)=A
1280 PRINT "X-SPEED=";:INPUT A
1290 U(I)=A/100
1300 PRINT "Y-SPEED=";:INPUT A
1310 V(I)=A/100
1320 NEXT I
1330 REM
1340 REM DO FINAL SETUP AND GO DO IT
1350 REM
1360 TRAP 100
1370 GRAPHICS 23
1380 GOTO 130
```

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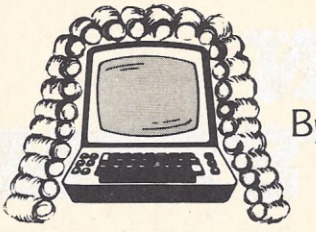
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CIRCLE INQUIRY NO. 36

Jurisprudent Computerist



By Elliott MacLennan
Attorney at Law

Taxation of Computer Technology: Part II

One of the deadliest of all federal income taxes that the software packager is uniquely (and regretfully) exposed to is the personal holding company tax. But it is possible to chart a commercially reasonable course to avoid or at least mitigate it.

The PHC levee taxes a corporation at 70%, that is 70% in addition to the standard federal tax. The percent of this 70% additional can result in a maximum tax on a corporation of 85% and a tax of its shareholders in excess of 95%.

A personal holding company is a corporation where more than half of its outstanding stock is owned by five or fewer people. To be a PHC, a corporation must generate 60% or more of its income from "passive" as opposed to "active" sources. As a general rule, passive income refers to investment income: dividends, interest, rents, annuities, and royalties (copyrighted or not).

A corporation that develops packaged software and receives 60% or more of its income from license royalties, and where 100% of its stock is owned by nine or fewer people, constitutes a personal holding company and is subject to the tax.

The reason its hardware-manufacturing cousin does not, requires an understanding of why Congress enacted the personal holding company in the first place.

Back in 1937, there was a 49% spread between maximum individual and corporate tax rates. Thus, many individuals found it highly advantageous to "incorporate" themselves. Not surprisingly, a stage full of movie stars incorporated themselves, their yachts, and their country estates. This became known in the trade as the "incorporated talent." Congress responded by enacting the personal holding company into law which, because of its confiscatory nature, had the effect of forcing unwilling shareholders to declare corporate profits to themselves in the form of dividends and thus pay the higher individual tax.

Had Congress stopped here, tax equity and fairness might have resulted. But Congress chose to impose PHC status on corporations whose primary source of income was from passive sources.

Assume you and I own all the stock of a small corporation that repairs computer peripheral equipment. We would be said to be an "operating company" and thus an active business, i.e. "actively" repairing computer terminals, and not subject to PHC rules.

Leasing one's software will receive more favorable tax treatment than licensing.

If we chose to invest our profits in your uncle's successful hardware manufacturing business, and 60% of our income now comes from his company dividends (and only 40% from our repair services), we are a PHC. Why? Because our investment produces passive income (dividends).

The dilemma for the software packaging corporation is that, although it is an operating company when it carries on an active trade or business, it becomes a PHC when it licenses its product and receives royalties.

However, the PHC law contains an exception that in effect treats rents more favorably than royalties. This exception is known as a "safe harbor." Generally, if more than 50% of a corporation's income is derived from rental income, it can escape PHC status. Therefore, leasing one's software will receive more favorable tax treatment than licensing.

What is the difference between a lease and a license? Basically, the distinction is that rents are fixed and certain without regard to use, royalties are based on percent of use actually made.

Another way to avoid PHC status is to characterize rents and royalties as "sale proceeds." One can have a sale even if payment is contingent upon usage. Important, however, is for seller to transfer all substantial rights in the product. If seller retains more dominion and control than would a normal creditor, no sale will occur, rather the "sale proceeds" will be a rent or royalty.

If, however, a software packager regards its product as an intangible, sale treatment will be highly improbable if the "seller" can sell its product on a nonexclusive basis (which, of course, a software packager must do to survive). Classifying income as "rent" from a lease would appear to be a more viable option.

The advice offered here by no means exhausts all possible solutions. If you suspect that your company is in danger of having PHC status imposed upon it, analyze the sources and amount of your income and then seek reclassification of that income. Or consult a competent legal advisor on a reasonable course of action. □

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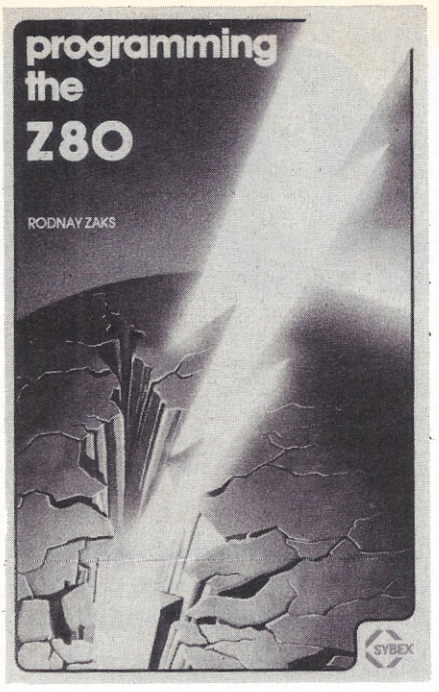
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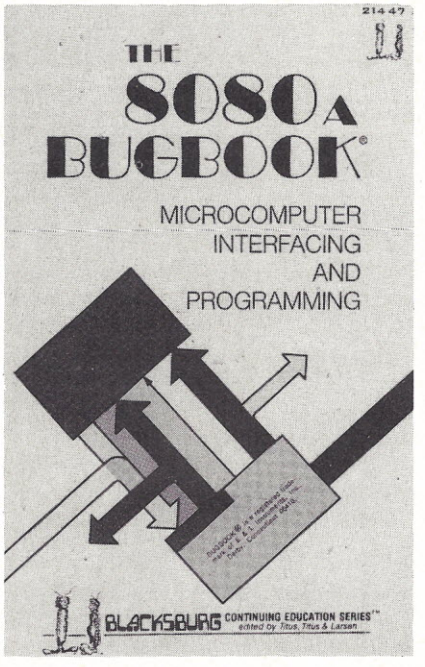
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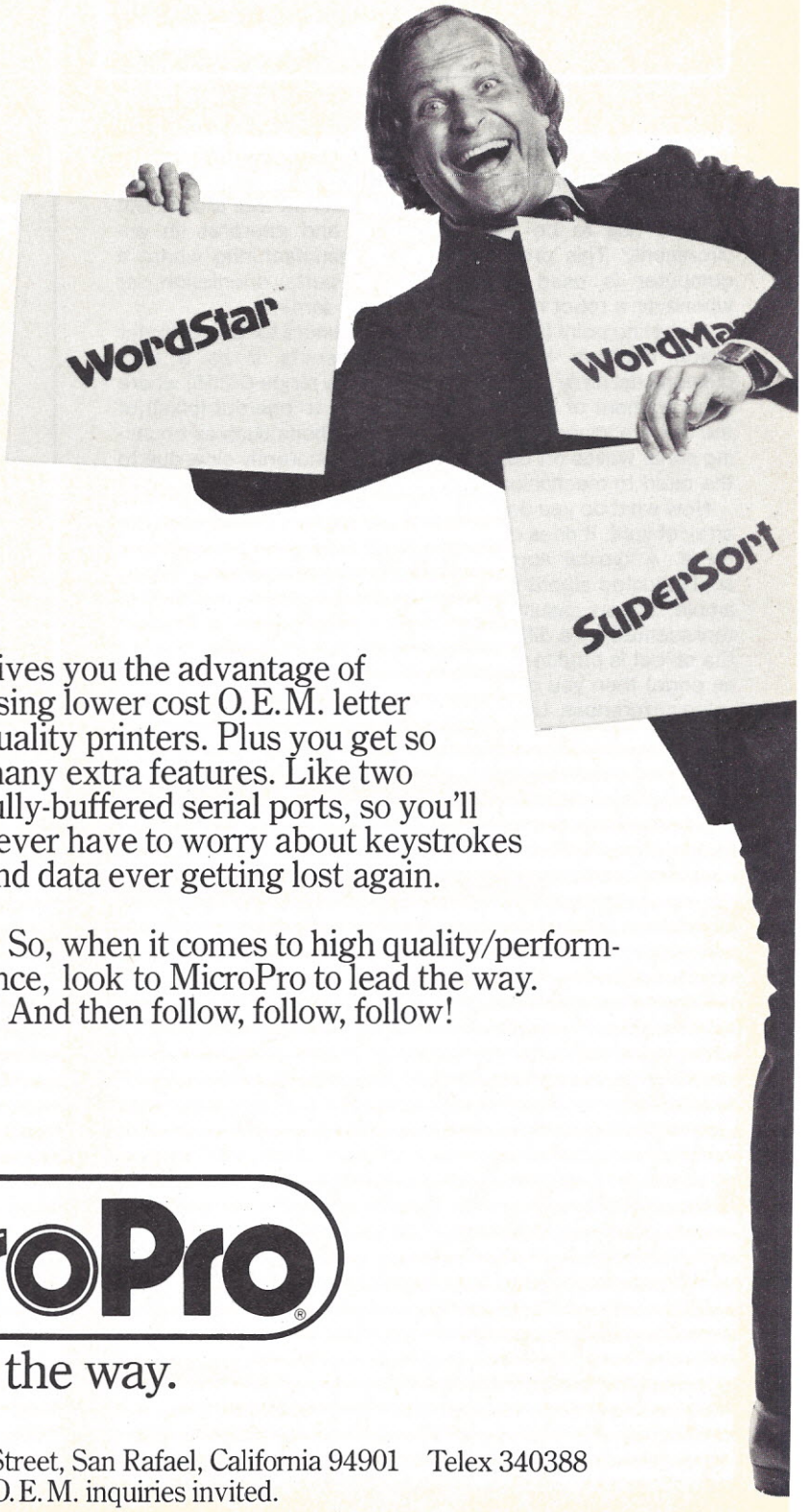
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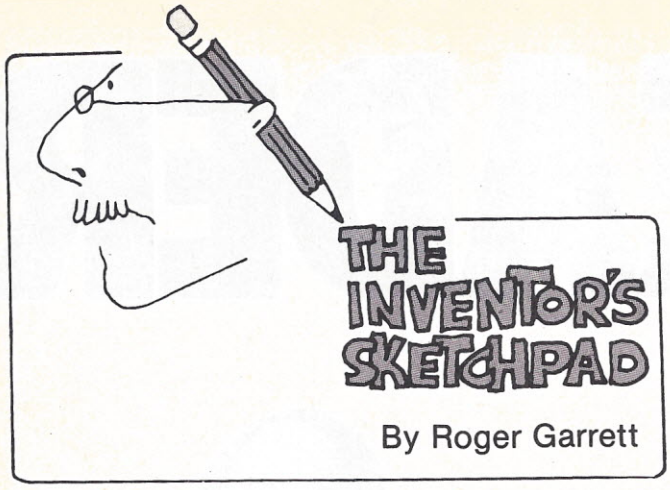
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By Roger Garrett

Automatic Acquisition of Three Dimensional Data

What do you do when a computer has to see what it is doing, when it is not sufficient for it to feel its way around but actually has to be able to look at and interpret its environment? This problem arises in manufacturing where a computer is used in assembly or parts orientation, or whenever a robot maneuvers on some terrain.

A starting point is to attach a video camera to the computer which digitizes the image and presents it as a two-dimensional array of light (typically in the range 0-255) where each element of the array corresponds to one dot (pixel) of the camera image. (There are other methods such as bouncing sonar waves off objects, but this is inherently slow due to the need to mechanically scan the area of interest.)

Now what do you do with this digitized image? Since it is an array of light, it does not directly tell the computer what is out there. A typical approach is to analyze the array, using sophisticated algorithms to search for object edges. For example, if you assume that the edge of an object will be represented by a different light intensity (i.e. one surface of the object is brighter than its adjacent surface, connected by an edge) then you can detect edges by searching for those value differences. Unfortunately, shadow edges are detected in the same way. There is no easy way to distinguish between an object and a shadow edge and you don't want the robot to reach for a shadow.

What we really need is a way to extract spatial information from the array of data and form a three-dimensional image. It would be much simpler then to recognize objects and to avoid grabbing shadows.

Obviously, I would not bring this matter up if I did not have an approach to explore and explain. What I have in mind is an analogy of the way humans determine distances to objects—by stereo vision. Through some as yet not understood process, our brain combines the information from our eyes and provides us with an understanding of distance. In no way do I claim to understand what the brain does with the visual information. It clearly does not perform digital processes and generate a distinct value as would a computer. I propose to use the computer to essentially accomplish the same process that the brain performs, although in a different manner.

Instead of two eyes, we will use two digitizing video cameras. In order to initially simplify the problem, we will assume that the computer is "looking at" a single bright spot in its field of view. Everything else is black. It might be a tiny light suspended in an otherwise darkened room or a spot on some object illuminated with a laser beam. In any case, the computer sees only one bright spot and must estimate the distance from the cameras to the spot (figure 1).

Notice we have a triangle formed by line A connecting the two cameras (the distance of which is known) and the lines joining the bright spot with the two cameras. If we reach back to our knowledge of trigonometry, we recall that a triangle

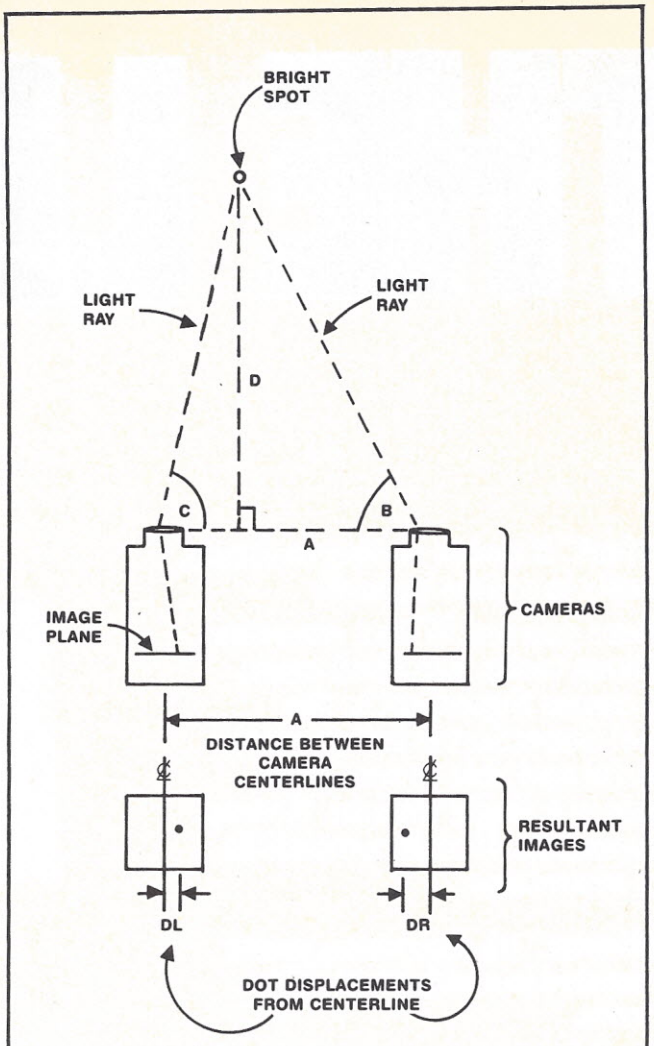


Figure 1.

may be defined by two angles and an included side. If we can define the triangle, we can solve for the distance D, which is the perpendicular line dropped from the bright spot to the line A. Since we know the length of A, if we can determine the angles B and C, we would have two angles and an included side, and can easily solve for D. All the computer has to deal with are two light intensity images, one from each camera. The computer cannot directly measure the angles A and B.

Ah, but it can measure them indirectly. Assume for a moment that the bright dot is directly in front of the left camera. Then the dot's image would be centered exactly on the image plane and the angle C would be 90°. If the bright dot is to the left or right of the camera, then the dot's image on the image plane would be appropriately displaced left or right, and the associated angle C would be respectively greater than or less than 90°. So the displacement of the dot's image has a one-to-one relationship with the angle C; likewise for the right camera's image and angle B. Since the computer can easily measure the displacements, and thereby determine the angles, it can calculate the distance D and know how far away the dot of light is.

We can see exactly how the computer determines these displacements by looking at a digitized scan line from each of the cameras (figure 2). (The cameras actually "scan" the image plane, dividing it into 512 scan lines, each containing 512 pixels. Each scan line is digitized, i.e. converted from analog light values to digital values, and stored as a single row in the two-dimensional data array that the computer can access. From this point on, however, I will use the term "scan line" to mean a single row of the data array.)

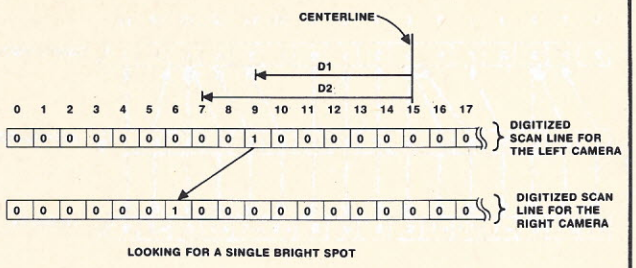


Figure 2.

The computer has selected the appropriate scan lines by searching one entire data array for a non-zero element (we assume zero means no light detected). When it finds the scan line with the bright spot in it (non-zero element), it takes that scan line (say, perhaps, scan line 37) and the corresponding scan line from the other camera which also contains a bright spot, and uses them to calculate the offsets.

In figure 2, we see a part of the two scan lines which the computer has selected. In this case, we assume that each scan line contains 32 elements so that element 15 constitutes the centerline of the scan line. We then count the number of pixels from the center pixel to the bright spot pixel to determine the displacement. In our sample, the displacement for the bright spot image in the left camera is –6 and for the right camera –9. The computer uses these displacements to determine the corresponding B and C angles, perhaps by a simple table look-up technique.

I have clearly made some oversimplified assumptions to show how this technique works. Very few systems requiring 3-D visual acquisition will utilize cameras that digitize to only one bit accuracy or have only a single bright spot to detect. In actual practice, the cameras will have a digitizing accuracy (number of bits per pixel) of 8 bits, or a range of 0 to 255, and

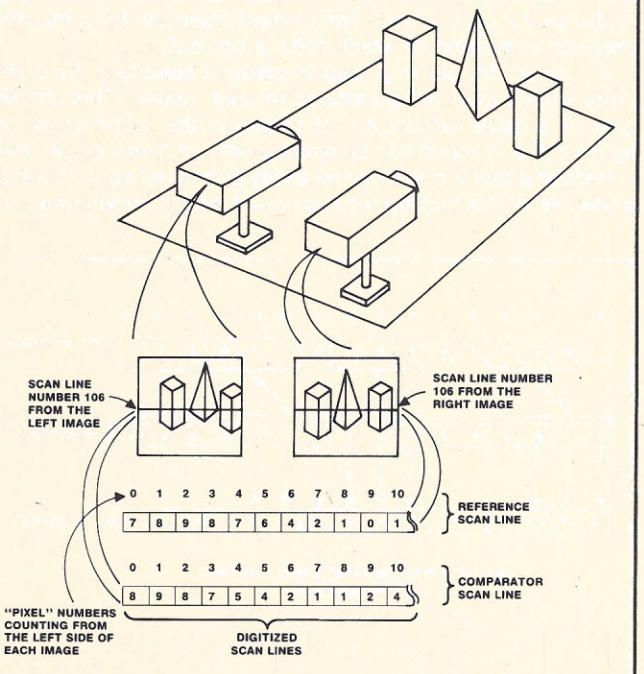


Figure 3.

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the cameras will be viewing complex-shaped objects. We will then want to determine the distance to every point in the image, not just a well-defined and easily recognizable spot.

In figure 3, the cameras are viewing and digitizing a complex image made up of a couple of boxes and a pyramid. The computer is currently processing scan line 106, somewhere near the middle of the image. Keep in mind that the following discussion applies to every single scan line in the image; the computer simply processes them one at a time.

In the previous example, the computer found one specific pixel, the one with the non-zero value (corresponding to the bright spot), and then located its corresponding pixel in the other image's scan line. Essentially it found a reference pixel in the one scan line and its corresponding comparator pixel in the other. So the distance value obtained applied to pixel 9 in the left scan line.

What we now want to do with our complex image is select one as a reference (it doesn't matter which) and calculate a distance value for every pixel in every scan line. By looking at the sample values in the scan lines, it might be rather difficult —given a particular value in a reference pixel—to find its corresponding comparator pixel. Of course, once we find it, we know the associated displacements and can calculate the distance. Let's try a few methods for determining the associated comparator pixel positions.

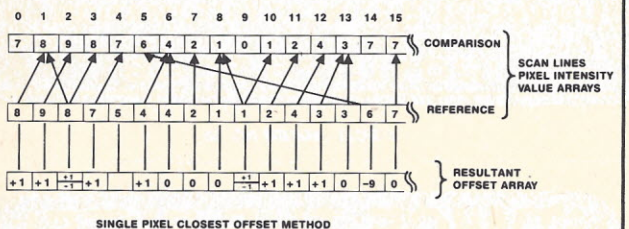


Figure 4.

The center row of numbers in figure 4 is the pixel values for the reference scan line. The upper row are the comparator pixels, and the bottom row is a set of values that the computer has calculated as "offset" values. The method used to determine the offset values is the single pixel closest offset method. At pixel 0 we have a value of 8. We search the comparison scan line for the closest pixel (to pixel 0) with a value of 8. In this case it occurs at pixel 1. The offset, then, is →1, which we put into the corresponding element of the offset array.

Consider now pixel 2 with a value of 8. There are two closest comparator pixels, one at location 1 and another at location 3, so the offset is either + 1 or −1 but we don't really know which. We cannot uniquely determine which comparator pixel corresponds to reference pixel 2. At reference pixel 14 with a value of 6, we see that the closest comparator pixel is at 5 with a resultant offset of −9. But this does not seem reasonable since the offsets for both pixels 13 and 14 are 0. It would tend to indicate that there is a discontinuity in the objects we are viewing (which of course is possible but we would like a better verification of it). At pixel 4 we have a reference value of 5, but no corresponding comparison value so we cannot calculate an offset value.

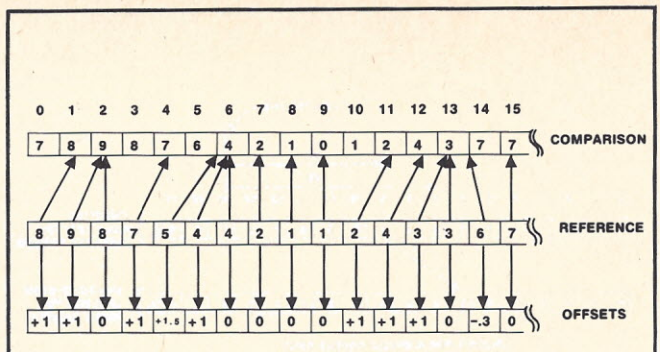


Figure 5.

So let's try interpolation (figure 5). We select an individual pixel from the reference line, but assume that the comparator line is actually a continuous line of values with known values. At reference pixel 4, for example, we have a value of 5 but no corresponding 5 in the comparator line. But at comparator pixels 5 and 6 we have values of 6 and 4, respectively. We can interpolate between them to find a value of 5 halfway between the pixels so the offset for reference pixel 4 is + 1.5. We should now be able to fill in the entire offset array.

For each reference pixel, the pixel number (not its value) effectively specifies its displacement from the centerline (the DL value in figure 1). The pixel number added to the corresponding offset specifies the displacement for its corresponding comparator pixel, which gives the DL value. With DL and DR known, we can calculate the distance from the camera to the part of the object represented by that pixel.

The problem with either of these methods is that the calculated offset values are not very reliable. They assume rather smooth variations of light intensity across the image and, since they are looking for closest numerical match, there is always the possibility of two closest pixels so the computer requires a decision of which pixel is correct.

So we will try using groups of pixels. Essentially the computer will be comparing *patterns* of pixel values. This should give us a more reliable set of values in the offset array. In figure 6 the computer is comparing sets of three pixels, but understand that it could just as easily compare two or more at a time. What it is looking for is an exact match. Reference pix-

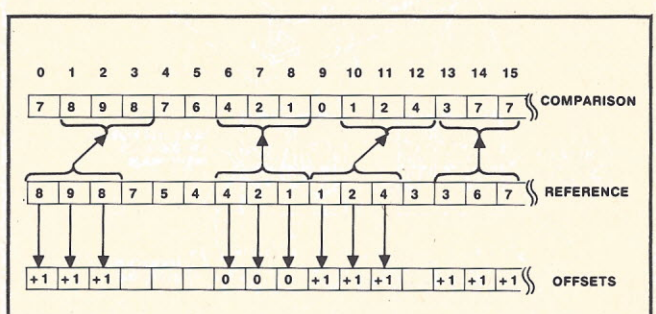
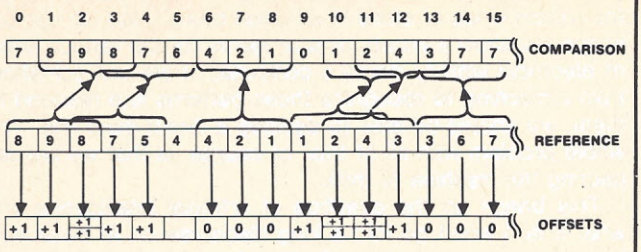


Figure 6.



MULTIPLE PIXEL CLOSEST OFFSET WITH APPROXIMATES METHOD PATTERN METHOD 2

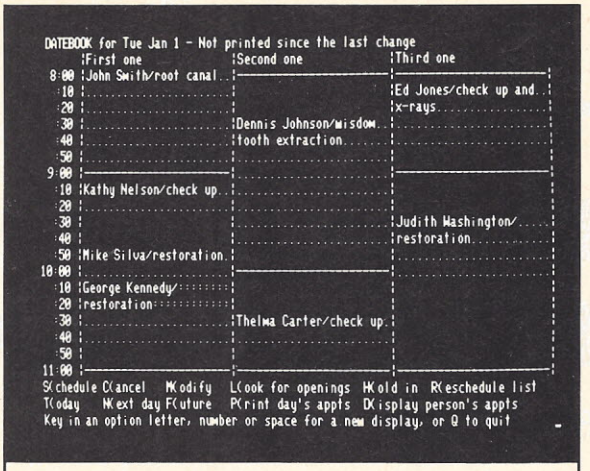
Figure 7.

els 0, 1, 2 exactly match comparison pixels 1, 2, 3 and the result offset is +1 for each of the pixels 0, 1, and 2. Note that every set of three pixels is checked. That is, pixels 0, 1, 2 are checked for an exact match, then pixels 1, 2, 3, then 2, 3, 4 and so on. Notice also that this can easily result in multiple offset values for any given individual reference pixel since, for example, reference set 8, 9, 10 might match with one comparater set, and reference set 10, 11, 12 might match with another. Reference pixel 10 would then match twice and have two offset values. One possible approach to the multiple offset value problem is to simply use the average of offsets for a given pixel with multiple offsets.

In the last method, we required exact pixel-for-pixel matches for each pixel set. But it may not be reasonable to assume that the pixel values will match exactly. Light may reflect brighter to one camera than the other. Even if the light is identical, it is highly improbable that both cameras will be identically tuned for image intensity and that both digital-to-analog convertors (for digitizing the images into pixel values) will perform identically. So it would probably be good to provide for some form of "approximate" pattern matching (figure 7). We might assume that two sets of pixels (one from the reference and one from the comparator lines) match if the sums of the pixel values in each set are identical, or perhaps are within some small value of each other. They might match if the values of the corresponding pixels of two sets are each within some range of each other. Any number of pattern matching schemes can be devised. The object is to find the one most reliable (that is, produces offsets which result in the most accurate distance (D) values for each pixel) and the fastest.

I would presume that some combination of these methods would provide the best results. Single pixel exact matching is the fastest but probably least reliable. Pattern matching may be the slowest and most difficult to implement but undoubtedly would be more reliable. As for speed, it would be ideal if the calculations could be done as fast as the image is received, which for most video cameras is 30 times a second. For each $\frac{1}{30}$-second, all 512 scan lines would have to be processed and converted to a corresponding distance array. The host computer receives a two-dimensional array where each element corresponds to a pixel of the image. The value of each element is the distance from the camera to the object at that pixel location. In other words, the array is a three-dimensional description of the objects being viewed. So, instead of looking for edges in an array of light values, the computer can look for actual 3-D surfaces and, using pattern matching techniques, look for specific objects. Even without looking for surfaces and recognizable objects, a robot using this form of visual information could easily traverse a terrain because it could tell when it is approaching obstacles.

If this sounds intriguing, then watch for next month's column. I will describe an experimental setup that investigates the concepts discussed here, using your own computer but without requiring any video cameras. □



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CIRCLE INQUIRY NO. 47



THE MIND REVOLUTION

By Merl Miller

How well can we communicate with each other or with machines? Last month, I tried to examine this question a little by introducing the concept of a natural language. This month, I would like to take this a little further and ask two fundamental questions—what kind of language can be developed and what can we do to develop it?

A new language would be, in some ways, quite different from any known language. To start with, it would have to be both universal and logical. As all languages developed in essentially the same way, this might be difficult. We simply have no experience developing logical languages. Languages are primarily symbolic representations of objects. In human languages, the symbol was probably some sort of noise representation that later became a written representation. Computer languages differ in that they were developed in reverse order. If the primary purpose in the language is to define objects and their interrelationship in an understandable manner, then all languages fail. This purpose must be clearly met before we can even attempt the secondary purpose of expressing ideas. When we understand this concept, we may be able to develop a natural language.

Languages do not clearly represent the way we think. Human beings seem to think (or operate, if you will) using pictorial impressions of some kind. We have always tried to express these impressions rather than the object that they represent. Until we can learn how to interpret these impressions directly, we will have to depend on language.

This problem is somewhat easier to understand when we examine machines. Machines operate using electrical representations of numbers rather than ideas. Although we can interpret the numbers the machine uses, we can't think in numbers the way a machine does. We, therefore, devise languages that are alien to the machine, but facilitate our use of it. If all of this has you totally confused, don't feel bad. It has me confused, also. This partially illustrates the problem with languages. We are trying to convey images and ideas using an imprecise and illogical form.

Before we can construct a natural language, we will need to understand how we use languages now. We will need to develop a psychological model of both the structure and form of human language. Having done this, we should be able to develop the new language in a logical and precise manner.

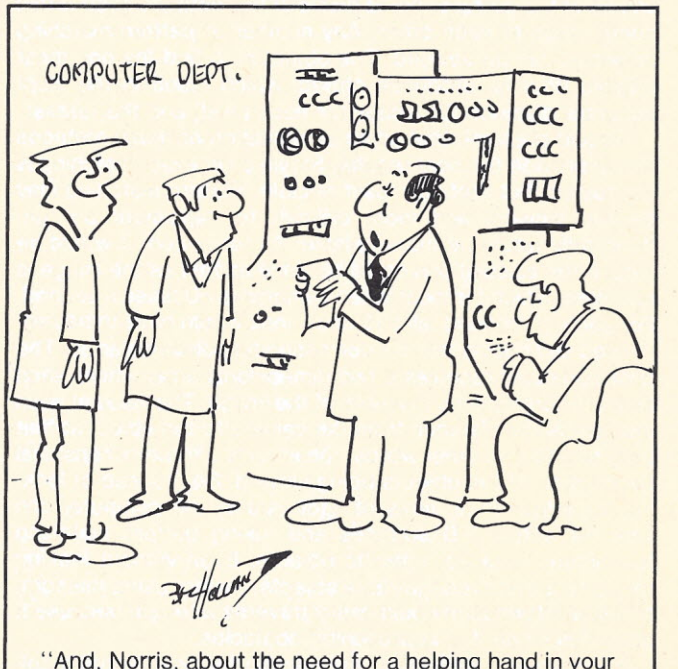
One sensible way to design this new language would be to let a computer do it. After all, computers are logical and precise, aren't they? Well, maybe. Computers are cold, calculating, precise, and logical, but they are programmed by human beings. We can't expect to have a computer design the language until they learn how to program themselves.

Perhaps the real solution to this problem is to develop a direct mind link between computers and humans. This isn't as far-fetched as you might think. We already know that computers use numbers to represent internal electrical activity. And we also know that a human being uses images to represent internal electrical activity. Measurements of electrical activity in both show that a distinct pattern develops for each different activity. For instance, an EEG will show alpha waves for certain kinds of sleep in a human being. Also, an oscilloscope will show a variety of sine waves for the various kinds of electrical activity inside a computer. If we can somehow train a machine to recognize these patterns and respond to them, we should be able to develop a direct mind link. The whole problem with all of this, of course, is that we are expecting the machine to think.

This brings up the question of artificial intelligence and what it is. I won't go into a long discourse on AI because I have covered it many times before. I would like to make one simple comment, though. Although there has been a lot of interesting work in this field, the real breakthrough has not yet been achieved. Computers still don't think in a way we recognize, they only respond. We need to develop a computer that can not only respond, but also adapt. When this happens we might be able to use a machine to develop a language.

As interesting as all of this is, it is at best a solution that will take a long time to develop. We need to develop a natural language on a more immediate basis. A more reasonable approach would be to put together some sort of development group, but there are some significant problems with this, also. Members of the group would have to both linguists and scientists. If they were one or the other, there would be so much bias toward their own ideas that they wouldn't listen to the other members of the group. And even though we may be able to solve this problem, we may not be able to solve the problem of native language. Being as everyone has a native tongue, how do we make sure that the new language isn't just an offshoot of an existing one? We might be able to devise a program that could find new words on an object basis, but who would develop the program? After all, programs reflect the programmer.

There may be a variety of solutions to this problem but we won't see any of them until we change our attitude toward language. Research in human languages seems to be aimed at developing an "off-shoot" language. Research in computer languages seems to be aimed toward developing a more "English" type language. There are some very good reasons for doing this, but it does point us in the wrong direction. The bright spot in all of this is that as we try to devise a more reasonable, intelligent way to communicate with machines, we might stumble across a method of communicating with each other. Let's hope so. □



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Utility pack #1: A collection of programs that you will find useful and maybe even necessary in your daily work (we did!). Includes:

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- payroll files • correspondence • accounts pay/rec
- programs • tax records • mailing lists

Encode/Decode is available in two versions:

Encode/Decode I provides a level of security suitable for normal use. Encode/Decode II provides enhanced security for the most demanding needs. Both versions come supplied on discette and with a complete user manual.

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- READ & WRITE • REPEAT . . . UNTIL • more

'Tiny' Pascal is fast. Programs execute up to ten times faster than similar BASIC programs.

SOURCE TOO! We still distribute source, in 'Tiny' Pascal, on each discette sold. You can even recompile the compiler, add features or just gain insight into compiler construction.

'Tiny' Pascal is perfect for writing text processors, real time control systems, virtually any application which requires high speed. Requires: 36K CP/M. Supplied with complete user manual and source on discette: $85.00.

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Learning with Micros

By Louis E. Frenzel, Jr.

Video Education for Users and Sellers

Companies like IBM and DEC know that education plays a major role in their businesses. This is particularly true in customer education. Each year computer manufacturers spend millions of dollars training customers to use computers to get the most value from them. These companies make a handsome profit doing this, and create smarter, self-reliant, more satisfied customers. Not a bad deal at all. Without such education, products would be harder to sell and customers would need more servicing.

Strangely enough, many personal computer manufacturers have not discovered customer education or recognized its value. Or else they haven't figured out how to implement it.

Radio Shack conducts some classes in its stores, Heath/Zenith offers self-study courses in programming, and both Radio Shack and Commodore offer CAI Basic programs. But this represents only a fraction of real needs and opportunities.

EDS's Evolution 1

One company has "discovered" education—and gone on to do something about it. It's Electronic Data Systems. Portia Isaacson, a spokeswoman and leader in the personal computer field, recognized early the importance of education in personal computing and went on to create Evolution 1.

This is a series of micro video cassettes programmed to teach computer subjects. The tapes' primary application is in retail computer stores, which are encouraged to set up video "learning centers" for customers.

Some of the programs available include:

- *Personal Computing*—an introduction, one tape, 10 minutes, designed as a sales tool; an overview of fun and benefits obtainable.
- *The Bottom Line*—an introduction to small business computing, one tape, 10 minutes, developed as a sales tool; aimed at small business owners and managers.
- *Basic*—elements of programming in Basic, four 20-30 minute tapes.
- *Apple Basic*—Basic programming on the Apple, same as above but customized, four 20-30 minute tapes.
- *Business Computing: Cut Down to Size*—how to select and use a microcomputer in business, two 15 minute tapes with student materials; three more tapes are planned for this series.
- *Little Computers: See How They Run*—technical aspects of microcomputer hardware and software, eight 20-30 minute tapes: Meet the Computer, Inside the Computer, CPU and Memory, Mass Storage, Character I/O Devices, Making Things Happen, Data Communications, and Speech, Music and Graphics.

The tapes are available in ½-inch Betamax and VHS home recorder formats as well as the industry standard ¾-inch U-matic format.

Evolution 1 tapes are well planned and professionally executed. I have reviewed most of them and my opinion is favorable. Here are some comments:

- Level of coverage is basically elementary; tapes are for those with little or no knowledge of computers. Anyone with experience would probably not find them helpful. A tip: EDS should be encouraged to develop more advanced programs.
- Programs are not interactive, that is, do not solicit or encourage viewer participation. It would be helpful to the learner to interact with the video material rather than play the role of a passive viewer. The tapes could be interspersed with questions, summaries, reviews, problems or quizzes which would further reinforce the otherwise excellent material.
- There is too much talk and not enough graphics or copy. Maybe this is just a personal objection, but I felt that listening was everything. There are places in the See How They Run series where the words come so fast and furious it is like trying to get a sip of water from an open fire plug. The words could have been backed up with more visuals.
- Some of the courses like Basic and Small Business do include student workbooks for review, summary and practice. All courses should have these; they provide the needed reinforcement mentioned earlier. Otherwise, once the student views the tapes, he or she is left with nothing. It may be necessary for some to go back over the tapes several times to learn or remember key points. If you own the tapes, that's easy. But in a learning center, school or home-lease situation, it's not easy. A workbook would ease this problem somewhat.

Store Learning Centers

Retail stores wishing to set up a customer learning center can lease Evolution 1 tapes at $35/tape per month. They can also be purchased at $125 to $375, depending upon program and quantity. While this represents a sizeable investment, these tapes also make money. The store charges for each course. These courses can attract and create new customers. . .and can be used promotionally to educate about computers and stress their value. The tapes also make good employee training programs for a new distributor, salesman or technician.

Home Applications

While the price is a bit steep for the average person, EDS has a special arrangement for individuals with a home VCR. It offers the Basic and business courses on a monthly rental basis for $155 and $105, respectively, through its mail order division Inovision.

When video disk units become more available next year, EDS should put the courses into this format. It would lower the price considerably and make them more reasonable to individuals.

School and Industry Uses

Evolution 1 will also find its way into schools and industry. Most programs make ideal supplements to computer literacy courses, and as introductory courses in high schools, colleges and universities. They might also be useful in continuing education programs for adults.

Evolution 1 is available from Electronic Data Systems, 14580 Midway Road, Dallas, TX 75234, toll free number 800-527-0278. □

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THE MICRO-MATHEMATICIAN

By Richard R. Parry

Simple Linear Regression: A Forecasting Tool

If crystal balls really worked, there would be little need to guess the future. Every businessman would have one of these prognostication tools to aid him or her in determining future inventory requirements, manpower allocations, sales, capital equipment needs, and much much more.

Unfortunately, the real world is frought with uncertainty. Managers must (or should) make decisions based on more than gut feeling. Management science offers many tools to aid the businessman in decision making. Simple linear regression is one such forecasting technique. This article describes the power and use of linear regression and provides a Basic program to enable one to forecast possible future data based on historical information.

While business managers will find linear regression a valuable tool in aiding decision making, the technique is not limited to the business world. Scientists and experimenters who find themselves in a position where they must describe a relationship based on experimental data can also use this tool. Both applications are discussed and examples given to indicate the power and use of the technique. The program has been designed to allow the user to store and retrieve data files. In this way, data can be added as information is acquired. The program was written using Technical Systems Consultants' Basic and its Flex version 2.0 disk operating system.

Basic Theory

The purpose of linear regression is to calculate a line that passes through all recorded data points. If all the points fit perfectly on a straight line, calculating the equation that described the line would not be difficult. However, data is often random or non-linear; the points may be scattered all over a graph. Such a graph is referred to as a scattergram. Fitting a straight line through points that are scattered on a graph then becomes somewhat subjective. Linear regression is used to remove the subjectivity of passing a line through a group of data points. It places a straight line through the scattered points such that the sum of the squares of the vertical deviations separating the line and the point is minimized. This line is referred to as a least squares line and serves as the basis for extrapolation.

The standard equation of a straight line is $Y = mX + b$. In this expression, Y is referred to as the dependent variable, X is the independent variable, m is the slope of the line, and b is the point where the line intersects the Y axis.

Opponents of simple linear regression argue that the real world does not change linearly. This may be especially true of some business fluctuations. Other methods such as moving averages, exponential smoothing, and multiple regression may in these situations give a more accurate picture of the trend.

In defense of simple linear regression, one should note that correlation analysis provides the user with a quantitative measure that indicates the degree to which the linear regression line agrees with the actual data. This, therefore, gives the user a good indication as to the fit of the regression line through the data and therefore its validity to the analysis. Correlation analysis is, therefore, a very useful auxiliary tool when performing regression analysis.

In this program, two correlation statistics are calculated, the coefficient of correlation and the coefficient of determination. The correlation coefficient may range from −1 to +1. Its value depends on the relationship between the two variables. A positive coefficient of correlation indicates that increases in one variable will correspond to increases in the other variable. In this case they are said to be directly related. On the other hand, a negative coefficient of correlation indicates that as one variable increases, the other decreases. Here the variables are inversely related. If the correlation coefficient is 0, the variables are not related. In other words, a change in one variable does not cause a change in the other. The larger the absolute value of the coefficient of correlation, the more closely the variables relate to each other. For example, if the coefficient were +1, an increase in one variable would indicate an identical increase in the other variable.

The coefficient of determination varies between 0 and +1. It is equal to the coefficient of correlation squared. This statistic can be interpreted as the proportion of the total variation in Y explained by the regression line. In example 1, the coefficient of determination was calculated to be .85 (rounded). This signifies that 85% of the total variation or scatter of the sales about their mean can be explained by the relationship between this variable and the corresponding year, as estimated by the regression line. Conversely, 15% of the variation is unexplained.

The user will have to determine what coefficient of determination is acceptable. In most cases, if not all, the coefficient of determination should be greater than 50% for the user to have confidence in the regression line analysis. In example 1, a sales forecasting application, the ability of the regression line to explain 85% of the variation appears reasonably high thus allowing the user to have confidence in the regression line analysis.

Using the Program

Forecasting sales is a common task that lends itself to simple linear regression (example 1). It shows sales volume for a 10 year period starting in 1970.

The program begins by asking the user for the prompt to be used when asked for data. For the sales forecasting example, 'year' is the independent variable prompt, and 'sales' is the dependent variable prompt. After the prompts have been initialized, the program is ready to accept data. After each number is typed, the user depresses the 'return' key to have the number inserted into the data pool.

When all data has been inserted, the user has several command options that can be used. Options include: 'backup,' 'table of elements,' 'edit,' 'calculate line statistics,' 'forecast,' 'plot graph,' 'retrieve old data file,' 'store new data file,' and 'done.' Since the program examines only the first character of the command, the user need not type the entire command. For example: B, T, E, C, F, P, R, S, and D are single characters that will initiate the commands mentioned above.

The 'backup' command is used when the user has incorrectly inserted the data. Each time this command is executed, the computer backs up one data element and allows one to reinsert the correct data. The 'edit' command, which will be described later, can also be used for this purpose. However, 'backup' is easier to use where the error was just made. In example 1, the user accidentally inserted 1975 for 'year(5)' when it should have read 1974. 'Backup' was used to correct this error.

Also shown in example 1 is the use of the 'table of elements' command which causes all the data in the data pool to be displayed. The format allows the user to easily check the data for accuracy before it is manipulated. At this time, if an error is found, the 'edit' command would be used to alter the data.

As shown, the 'calculate line statistics' command gives the user the equation of the least squares line as well as the coefficient of correlation and coefficient of determination.

While a regression line equation is important, a plot of the data greatly aids one in conceptualizing the relationship. The 'plot mode' command is provided to this purpose. The user merely supplies the range and increment of the independent variable. In example 1, the lower limit is 1970, the upper limit is 1984, and the increment is one year. In order to make the graph easier to read, the user is prompted to supply the label of the X and Y axes which are to be printed along with the graph. In the example, year is the X axis and sales ($000) is the Y axis. Note that the regression line points are indicated by *, the input data points are shown by H, and the points where they coincide are shown by X.

While a graph is a concise and easy way to express data, it lacks precision. For those wishing precise data, a forecast mode is available. This mode is called by typing 'forecast' or F. Using the forecasting mode, the exact value of sales for 1981 and 1982 is found to be $47,911 and $50,295, respectively. Reading such accurate values from the graph would be impossible. To return to the input data mode, one types 'return' or R.

The program allows one to store and retrieve data files. For sales forecasting, this is a virtual necessity since each year the user will want to add sales data to the previous years sales without having to reinsert all previous data. To create a data file, merely type 'store' or S. The computer will respond by requesting the user to supply a name for the file. In the example, data was stored under the name 'saledata.' In a similar vein, when one wishes to retrieve the data to add or reexamine information, the user types 'retrieve' or R.

The edit mode, initiated by 'edit' or E, is provided to allow the user to correct any errors. It may also be used to allow the businessman to examine how the sales in certain years affect the forecast. This would in essence be a sensitivity analysis of the data. Example 1 shows how to take advantage of such a feature. Suppose it was observed that the sales figures for 1973 and 1979 were adversely affected by the oil embargo and oil price increases. While the 1973 and 1979 sales figures are correct, the user may feel that these figures are so unique that all they really do is to introduce error for future sales extrapolation. Thus the manager may wish to alter the sales figures for these years and examine the results without the effect of the oil crisis.

Example 1 shows how the 'edit' command was used to alter the sales for 'year(4)' and 'year(10)' to $29,000 and $47,000 respectively. Once again, to return to the input data mode, type 'return' or R. With this data altered, the user may once again use any of the previously mentioned commands to study the data. The 'done' command is used to exit the program.

Simple linear regression analysis lends itself to fields other than business. It may be used whenever there is a need to analyze a relationship between two variables. Example 2 shows an additional application: how material expands and contracts as a function of temperature. The data, consisting of 11 points, was previously stored under the data file name 'metalexp.' Therefore, 'retrieve' was used to reinsert the data. Note the ability of the program to plot in all four quadrants of the graph.

About the Program

REM statements are used throughout to help understand the program. However, there are a few points worthy of additional explanation.

The first statement (line 10) is a 'dimension' statement, used to indicate the amount of memory to set aside for the X and Y data pairs. The program shows that a maximum of 50 pairs are allowed. The user can increase or decrease this statement based on needs and memory resources.

Note that the X axis is not always at Y = 0, nor is the Y axis always at X = 0. The axes play an important role in reading a

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graph. Therefore, the axes are always printed. In addition, their location is calculated and displayed. In the case of example 1, the Y axis is shown at $21,000, and the X axis at 1970. While the Y axis could have started at 0, to do so would decrease the resolution of the graph.

Lastly, minimum and maximum values of Y are manipulated in such a way as to display easily readable values on the Y axis. If, for example, the minimum value of Y was 946.78 and the maximum value 12404.6, the Y increment would be 229.1564 [(12404.6–946.78)/50]. However, by reducing the lower limit of Y to two significant digits (see lines 1080 to 1190) and then modifying the maximum value of Y so it is evenly divisible by 50 (lines 1200 through 1240), the lower and upper values of Y become 940 and 15940 respectively. This yields a graph with a Y increment of 300 which is far easier to read than the unmodified Y axis. The reason for changing the range to be evenly divisible by 50 stems from the fact that the graph is broken into 50 divisions. This does not include the 10 columns to the left of the graph which are provided for the X axis title and values. □

Example 1. Sales forecasting application using all command options.

```
RUN

X AXIS PROMPT? YEAR
Y AXIS PROMPT? SALES

***INSERT DATA MODE***
YEAR( 1 )=? 1970
SALES( 1 )=? 22354
YEAR( 2 )=? 1971
SALES( 2 )=? 26588
YEAR( 3 )=? 1972
SALES( 3 )=? 27965
YEAR( 4 )=? 1973
SALES( 4 )=? 21892
YEAR( 5 )=? 1975
SALES( 5 )=? 8
YEAR( 5 )=? 1974
SALES( 5 )=? 31244
YEAR( 6 )=? 1975
SALES( 6 )=? 34212
YEAR( 7 )=? 1976
SALES( 7 )=? 36547
YEAR( 8 )=? 1977
SALES( 8 )=? 39871
YEAR( 9 )=? 1978
SALES( 9 )=? 44521
YEAR( 10 )=? 1979
SALES( 10 )=? 38957
YEAR( 11 )=? TABLE

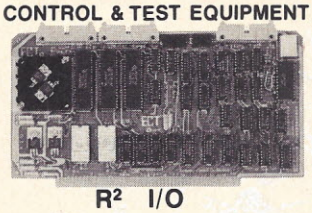
***TABLE OF ELEMENTS***
YEAR( 1 )= 1970          SALES( 1 )= 22354
YEAR( 2 )= 1971          SALES( 2 )= 26588
YEAR( 3 )= 1972          SALES( 3 )= 27965
YEAR( 4 )= 1973          SALES( 4 )= 21892
YEAR( 5 )= 1974          SALES( 5 )= 31244
YEAR( 6 )= 1975          SALES( 6 )= 34212
YEAR( 7 )= 1976          SALES( 7 )= 36547
YEAR( 8 )= 1977          SALES( 8 )= 39871
YEAR( 9 )= 1978          SALES( 9 )= 44521
YEAR( 10 )= 1979         SALES( 10 )= 38957

***INSERT DATA MODE***
YEAR( 11 )=? CALCULATE


***LINE STATISTICS***
SLOPE M= 2384
Y INTERCEPT=-4.67479E+06
COEFFICIENT OF DETERMINATION= .854123
COEFFICIENT OF CORRELATION= .924188
EQUATION IS Y= 2384 X+(-4.67479E+06 )

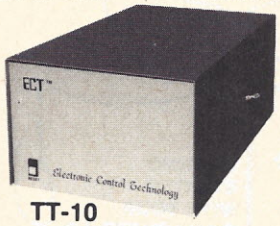
***INSERT DATA MODE***
YEAR( 11 )=? PLOT
```


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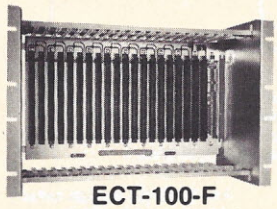
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```
***PLOT MODE***

LOWER LIMIT OF X=? 1970
UPPER LIMIT OF X=? 1984
INCREMENTS OF X=? 1
X AXIS LABEL=? YEAR
Y AXIS LABEL=? SALES ($000)
Y INCREMENT= 700
Y AXIS AT X= 1970
X AXIS AT Y= 21000
```

```
                    SALES ($000)
          21000     28000     35000     42000     49000     56000
            +---------+---------+---------+---------+---------+
Y  1970     I*H-------------------------------------------------
E  1971     I   *   H
A  1972     I       * H
R  1973     IH        *
   1974     I             X
   1975     I               *H
   1976     I                 *H
   1977     I                   * H
   1978     I                     *     H
   1979     I                   H     *
   1980     I                           *
   1981     I                             *
   1982     I                               *
   1983     I                                 *
   1984     I                                   *
```

```
***INSERT DATA MODE***
YEAR( 11 )=? FORECAST


***FORECAST MODE, TYPE R TO RETURN***
FOR YEAR? 1981
EXTRAPOLATED SALES IS  47911

FOR YEAR? 1982
EXTRAPOLATED SALES IS  50295

FOR YEAR? RETURN

***INSERT DATA MODE***
YEAR( 11 )=? SAVE DATA
NAME OF DATA FILE TO BE STORED ? SALEDATA

***INSERT DATA MODE***
YEAR( 11 )=? EDIT

***EDIT MODE, TYPE R TO RETURN***
DO YOU WISH TO EDIT X OR Y ELEMENT? Y
WHAT ELEMENT NUMBER N=? 4
NEW ELEMENT VALUE Y 4 =? 29000
DO YOU WISH TO EDIT X OR Y ELEMENT? Y
WHAT ELEMENT NUMBER N=? 10
NEW ELEMENT VALUE Y 10 =? 47000
DO YOU WISH TO EDIT X OR Y ELEMENT? RETURN

***INSERT DATA MODE***
YEAR( 11 )=? FORECAST


***FORECAST MODE, TYPE R TO RETURN***
FOR YEAR? 1981
EXTRAPOLATED SALES IS  51495.5

FOR YEAR? 1982
EXTRAPOLATED SALES IS  54198

FOR YEAR? RETURN

***INSERT DATA MODE***
YEAR( 11 )=? DONE


READY
```


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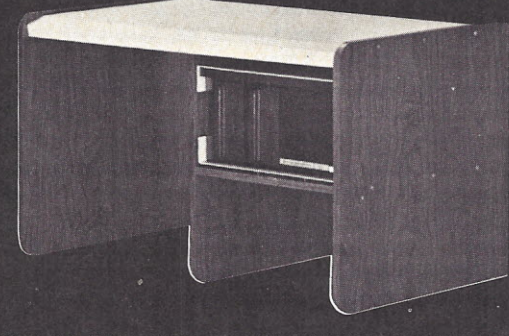
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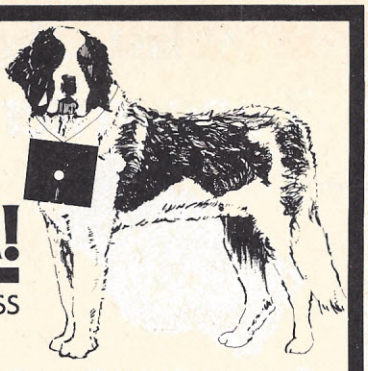
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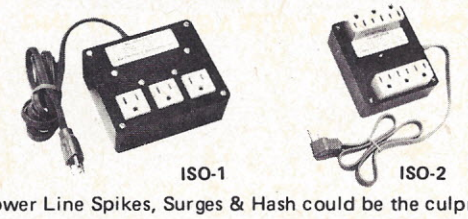
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Example 2. Displays flexibility of plotting feature.

```
RUN

X AXIS PROMPT? TEMP
Y AXIS PROMPT? EXP

***INSERT DATA MODE***
TEMP( 1 )=? R
NAME OF DATA FILE TO BE RETRIEVED ? METALEXP

***INSERT DATA MODE***
TEMP( 12 )=? PLOT


***PLOT MODE***

LOWER LIMIT OF X=? -400
UPPER LIMIT OF X=? 600
INCREMENTS OF X=? 50
X AXIS LABEL=? TEMPERATURE DEGREES F
Y AXIS LABEL=? MATERIAL EXPANSION MM
Y INCREMENT= .5
Y AXIS AT X= 0
X AXIS AT Y=-.2
```

```
                    MATERIAL EXPANSION MM
        -8.7      -3.7       1.3       6.3       11.3      16.3
          +---------+---------+---------+---------+---------+
T -400    X                   |
E -350      *                 |
M -300        * H             |
P -250          *             |
E -200            * H         |
R -150              *         |
A -100                *H      |
T -50                   *     |
U  0      ----------------H*--|-------------------------------
R  50                       |*
E  100                      |  H*
   150                      |     *
D  200                      |     H *
E  250                      |         *
G  300                      |         H *
R  350                      |             *
E  400                      |             H  *
E  450                      |                 *
S  500                      |                 H*
   550                      |                    *
F  600                      |                       *     H
```

```
***INSERT DATA MODE***
TEMP( 12 )=? DONE


READY
```

PROGRAM LISTING

```
 10 DIM X(50),Y(50),Z(10)
 20 ON ERROR GOTO 2410
 30 REM **** LEAVE 10 SPACES FOR X AXIS LABEL AND SET FIRST INPUT TO 1
 40 LO=10: N=1
 50 INPUT "X AXIS PROMPT";XP$
 60 INPUT "Y AXIS PROMPT";YP$
 70 REM ****
 80 REM ****
 90 PRINT:PRINT "***INSERT DATA MODE***"
100 PRINT XP$;"(";N;")=";
110 INPUT XD$
120 IF LEFT$(XD$,1)="B" THEN 220
130 IF LEFT$(XD$,1)="C" THEN 610
140 IF LEFT$(XD$,1)="T" THEN 540
150 IF LEFT$(XD$,1)="D" THEN END
160 IF LEFT$(XD$,1)="E" THEN 790
170 IF LEFT$(XD$,1)="F" THEN 710
180 IF LEFT$(XD$,1)="P" THEN 900
190 IF LEFT$(XD$,1)="R" THEN 310
200 IF LEFT$(XD$,1)="S" THEN 430
210 X(N)=VAL(XD$): GOTO 230
220 N=N-1
230 PRINT YP$;"(";N;")=";
240 INPUT YD$
250 IF YD$="B" THEN 100
260 Y(N)=VAL(YD$)
270 N=N+1: GOTO 100
280 REM ****
290 REM ****
300 REM **** GET DATA FROM OLD HISTORY DATA FILE
310 INPUT "NAME OF DATA FILE TO BE RETRIEVED";DR$
320 OPEN OLD DR$ AS 1
330 REM **** READ NUMBER OF POINTS
340 INPUT #1,N
350 REM **** READ ALL X AND Y POINTS
```

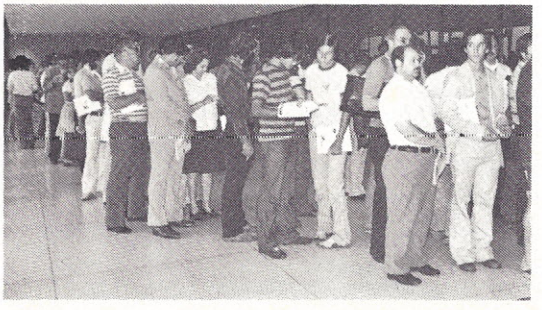
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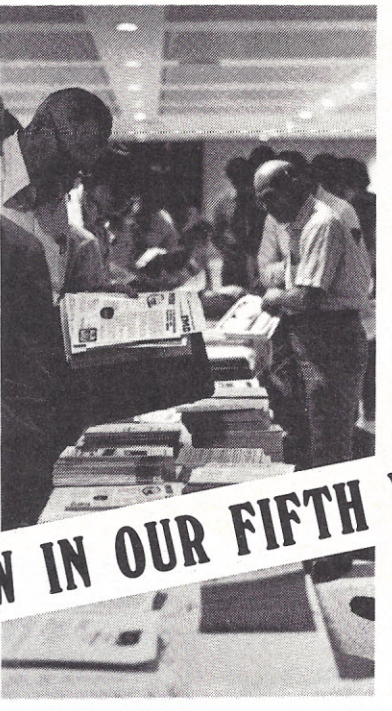
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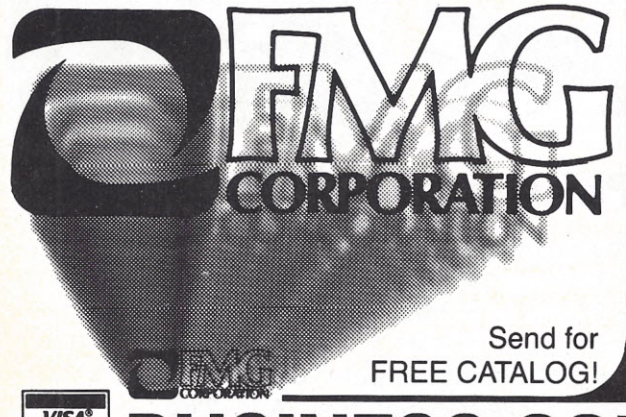
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```
360 FOR M=1 TO N
370 INPUT #1,X(M),Y(M)
380 NEXT M
390 N=N+1: CLOSE 1: GOTO 90
400 REM ****
410 REM ****
420 REM **** STORE DATA IN HISTORY DATA FILE
430 INPUT "NAME OF DATA FILE TO BE STORED ";DS$
440 OPEN NEW DS$ AS 1
450 REM **** STORE NUMBER OF POINTS
460 PRINT #1,N-1
470 REM **** STORE ALL X AND Y POINTS
480 FOR M=1 TO N-1
490 PRINT #1,X(M);",";Y(M)
500 NEXT M
510 CLOSE 1: GOTO 90
520 REM ****
530 REM ****
540 PRINT :PRINT "***TABLE OF ELEMENTS***"
550 FOR M=1 TO N-1
560 PRINT XP$;"(";M;")=";X(M),YP$;"(";M;")=";Y(M)
570 NEXT M
580 GOTO 90
590 REM ****
600 REM ****
610 PRINT :PRINT :PRINT "***LINE STATISTICS***"
620 GOSUB 2240
630 PRINT "SLOPE M= ";MS
640 PRINT "Y INTERCEPT=";B
650 PRINT "COEFFICIENT OF DETERMINATION=";CC*CC
660 PRINT "COEFFICIENT OF CORRELATION=";CC
670 PRINT "EQUATION IS Y=";MS;"X";"+(";B;")"
680 GOTO 90
690 REM ****
700 REM ****
710 PRINT :PRINT :PRINT "***FORECAST MODE, TYPE R TO RETURN***"
720 GOSUB 2240
730 PRINT "FOR ";XP$;
740 INPUT XO$
750 IF LEFT$ (XO$,1)="R" THEN 90
760 XO=VAL(XO$)
770 YO=MS*XO+B
780 PRINT "EXTRAPOLATED ";YP$;" IS ";YO:PRINT : GOTO 730
790 PRINT :PRINT "***EDIT MODE, TYPE R TO RETURN***"
800 INPUT "DO YOU WISH TO EDIT X OR Y ELEMENT";T$
810 IF LEFT$ (T$,1) = "R" THEN 90
820 IF T$<>"X" AND T$<>"Y" THEN 800
830 INPUT "WHAT ELEMENT NUMBER N=";N1
840 PRINT "NEW ELEMENT VALUE ";T$;N1;"=";
850 INPUT X9
860 IF T$="X" THEN X(N1)=X9 ELSE Y(N1)=X9
870 GOTO 800
880 REM ****
890 REM ****
900 PRINT :PRINT :PRINT "***PLOT MODE***":PRINT
910 GOSUB 2240
920 INPUT "LOWER LIMIT OF X=";L1
930 INPUT "UPPER LIMIT OF X=";L2
940 IF L2=L1 OR L2<L1 GOTO 920
950 INPUT "INCREMENTS OF X=";L3
960 INPUT "X AXIS LABEL=";X$
970 INPUT "Y AXIS LABEL=";Y$
980 REM **** COMPUTE MIN AND MAX OF REGRESSION LINE
990 Y7=MS*L2+B : Y8=MS*L1+B
1000 IF Y8>Y7 THEN Y3=Y7:Y4=Y8: GOTO 1030
1010 Y3=Y8:Y4=Y7
1020 REM **** COMPARE MIN AND MAX OF LINE WITH HISTORY MIN AND MAX
1030 FOR M=1 TO N-1
1040 IF X(M)<(L1-L3/2) OR X(M)>=(L2+L3/2) GOTO 1070
1050 IF Y(M)>Y4 THEN Y4=Y(M)
1060 IF Y(M)<Y3 THEN Y3=Y(M)
1070 NEXT M
1080 REM **** ROUND MIN (Y3) TO 2 SIGNIFICANT DIGITS < ORIGINAL VALUE
1090 IF Y3=0 GOTO 1200
1100 Z=INT(LOG(ABS(Y3))/LOG(10)-1)
1110 IF SGN(Y3)=-1 GOTO 1170
1120 REM **** Y3 IS POSITIVE
1130 IF Y3<1 THEN Y3=INT(Y3*10^ABS(Z))/10^ABS(Z) : GOTO 1200
1140 IF Y3<10 THEN Y3=INT(Y3*10)/10 : GOTO 1200
1150 GOTO 1190
1160 REM **** Y3 IS NEGATIVE
1170 IF Y3>-1 THEN Y3=-(INT(ABS(Y3)*10^ABS(Z)+1))/10^ACS(Z): GOTO 1200
1180 IF Y3>-10 THEN Y3=INT(Y3*10)/10 : GOTO 1200
1190 Y3=-INT(Y3/10^Z)*10^Z
1200 REM **** REPLACE MAX (Y4) WITH MULTIPLE OF 50
1210 Z2=5*10^(INT(LOG(Y4-Y3)/LOG(10)-1))
1220 Y5=(Z2*(INT((Y4-Y3)/Z2)+1))/50
1230 PRINT "Y INCREMENT=";Y5
1240 Y4=Y5*50+Y3
1250 REM **** CALCULATE LOCATION OF Y AXIS
1260 FOR M=L1 TO L2 STEP L3
1270 REM **** IF LOOPING IS ABOUT TO END, FORCE X AXIS TO LAST VALUE
1280 IF M >= (L2-L3*.5) GOTO 1300
1290 IF ABS(M)>ABS(M+L3) GOTO 1310
1300 PRINT "Y AXIS AT X=";M:X4=M: GOTO 1320
1310 NEXT M
1320 REM **** COMPUTE SCALE FACTOR BASED ON MAX AND MIN Y
1330 K1=50/ABS(Y3-Y4)
1340 REM **** COMPUTE COLUMN OF X AXIS (K4)
1350 FOR M=Y3 TO Y4 STEP Y5
1360 REM **** DUE TO ROUNDING ERROR STOP LOOPING WITH NEXT STATEMENT
1370 IF M >= (Y4-Y5*.5) GOTO 1390
1380 IF ABS(M)>=ABS(M+Y5) GOTO 1410
1390 PRINT "X AXIS AT Y=";M
1400 K4=INT(ABS((M-Y3)*K1)+.5)+LO : GOTO 1420
1410 NEXT M
1420 REM **** PRINT LABEL OF Y AXIS AND Y SCALE
1430 PRINT :PRINT :PRINT :PRINT TAB(20);Y$
```

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CE AGE 47

CIRCLE INQUIRY NO. 20

```
1440 PRINT TAB(LO-3);Y3;
1450 PRINT TAB(LO+7);.2*(Y4-Y3)+Y3;
1460 PRINT TAB(LO+17);.4*(Y4-Y3)+Y3;
1470 PRINT TAB(LO+27);.6*(Y4-Y3)+Y3;
1480 PRINT TAB(LO+37);.8*(Y4-Y3)+Y3;
1490 PRINT TAB(LO+47);Y4
1500 REM **** PRINT Y AXIS LINE
1510 PRINT TAB(LO);"+---------+---------+---------+---------+---------+"
1520 REM **** FOR ALL X POINTS COMPUTE Y AND PRINT GRAPH
1530 K0=0
1540 FOR M1=L1 TO L2 STEP L3
1550 REM **** PRINT LABEL OF X AXIS
1560 F1=F1+1: PRINT MID$(X$,F1,1);TAB(2);M1;
1570 REM **** COMPUTE REGRESSION LINE Y FOR GIVEN X AND NORMALIZE
1580 K2=INT((M5*M1+B-Y3)*K1+.5)+LO
1590 REM **** PRINT Y AXIS
1600 IF F=1 OR M1<>X4 GOTO 1750
1610 GOSUB 1940
1620 PRINT TAB(LO);
1630 FOR M=LO TO (LO+50)
1640 IF K0>0 AND M=K2 AND M=K3 THEN PRINT "X"; ELSE 1670
1650 GOSUB 2140
1660 GOTO 1730
1670 IF M=K2 THEN PRINT "*";: GOTO 1730
1680 IF K0>0 AND M=K3 THEN PRINT "H"; ELSE 1710
1690 GOSUB 2140
1700 GOTO 1730
1710 IF M=K4 THEN PRINT "I";: GOTO 1730
1720 PRINT "-";
1730 NEXT M
1740 F=1: PRINT : GOTO 1920
1750 REM **** PRINT THE REGRESSION LINE POINT (K2)
1760 REM **** PRINT THE X AXIS POINT IF APPLICABLE (K4)
1770 REM **** PRINT THE HISTORY POINT IF APPLICABLE (K3)
1780 GOSUB 1940
1790 FOR M=LO TO (LO+50)
1800 PRINT TAB(M);
1810 IF K0>0 AND M=K2 AND M=K3 THEN PRINT "X"; ELSE 1840
1820 GOSUB 2140
1830 GOTO 1890
1840 IF M=K2 THEN PRINT "*";: GOTO 1890
1850 IF K0>0 AND M=K3 THEN PRINT "H"; ELSE 1880
1860 GOSUB 2140
1870 GOTO 1890
1880 IF M=K4 THEN PRINT "I";: GOTO 1890
1890 IF M>K2 AND M>K4 AND M>K3 GOTO 1910
1900 NEXT M
1910 PRINT
1920 NEXT M1
1930 GOTO 90
1940 REM **** THIS ROUTINE FINDS,COUNTS, AND STORES THE NUMBER
1950 REM **** OF Y VALUES FOR A GIVEN X.  IF > 1 VALUE IS
1960 REM **** FOUND, THE VALUES ARE SORTED.
1970 FOR M=1 TO N-1
1980 IF X(M)>=(M1-L3/2) AND X(M)<(M1+L3/2) THEN K0=K0+1 ELSE 2000
1990 Z(K0)=Y(M)
2000 NEXT M
2010 IF K0<2 THEN 2120
2020 REM **** SORT ROUTINE
2030 K5=0
2040 FOR M=K0 TO 2 STEP -1
2050 IF Z(M) <= Z(M-1) THEN 2100
2060 Z1=Z(M)
2070 Z(M)=Z(M-1)
2080 Z(M-1)=Z1
2090 K5=1
2100 NEXT M
2110 IF K5=1 THEN 2030
2120 K3=INT((Z(K0)-Y3)*K1+.5)+LO
2130 RETURN
2140 REM **** PREPARE FOR NEXT POINT TO BE PRINTED
2150 K0=K0-1
2160 IF K0=0 THEN RETURN
2170 REM **** SKIP TO NEXT Y VALUE IF Y VALUES ARE INDENTICAL
2180 IF Z(K0)=Z(K0+1) GOTO 2150
2190 K3=INT((Z(K0)-Y3)*K1+.5)+LO
2200 RETURN
2210 REM ****
2220 REM ****
2230 REM **** SUBROUTINE TO COMPUTE REGRESSION STATISTICS
2240 N=N-1
2250 IF N<2 THEN PRINT "TWO OR MORE POINTS REQUIRED": GOTO 2370
2260 F1=0: F=0: S1=0: Y1=0: Y2=0: X1=0: X2=0
2270 FOR M=1 TO N
2280 S1=S1+X(M)*Y(M)
2290 X1=X(M)+X1
2300 Y1=Y(M)+Y1
2310 X2=X2+X(M)*X(M)
2320 Y2=Y2+Y(M)*Y(M)
2330 NEXT M
2340 M5=(S1-(X1*Y1)/N)/(X2-(X1*X1)/N)
2350 B=(Y1-M5*X1)/N
2360 CC=(S1-X1*Y1/N)/(SQR((X2-X1*X1/N)*(Y2-Y1*Y1/N)))
2370 N=N+1
2380 RETURN
2390 REM ****
2400 REM ****
2410 REM **** FLEX DISK ERROR MESSAGES
2420 IF ERR=7 GOTO 220
2430 IF ERR<>4 THEN ON ERROR GOTO 0
2440 PRINT "THE FILE COULD NOT BE FOUND"
2450 GOTO 2470
2460 PRINT "ALL DISK SPACE HAS BEEN USED"
2470 CLOSE 1
2480 RESUME 90

READY
```


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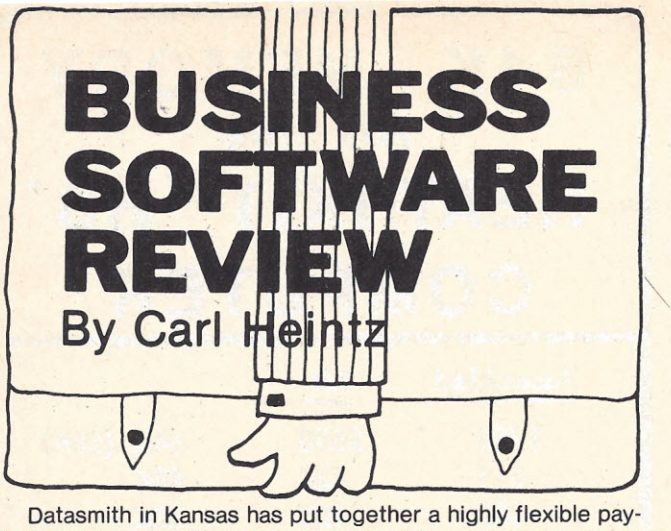
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CIRCLE INQUIRY NO. 43

BUSINESS SOFTWARE REVIEW

By Carl Heintz



Datasmith in Kansas has put together a highly flexible payroll program designed for the Micropolis operating system. As far as what makes a good payroll system? Software authors and accountants agree that there's no pat answer—individual needs vary so widely. But there are, however, some common grounds for comparison.

1. "Before the fact" versus "after the fact." A before-the-fact system records hours and internally generates the payroll deductions, taxes and net pay. Most systems actually write the check, and are appropriate for a business application in which many payroll checks must be written, and where employees' checks differ.

 An after-the-fact payroll system simply records information generated by other means. In other words, it simply "keeps the books." This is generally ideal for an accountant who does client bookkeeping monthly.
2. Departmental records. Many payroll systems allow the user to keep time by department or branch. This can be critical in a job-shop environment, for example, where management needs an up-to-date and accurate accounting of job time.
3. Multiple state tables. A few fancy payroll systems offer multiple state tables for computing disability and withholding taxes. These enable a company with employees in several states to accurately calculate each employee's taxes according to his state laws. A useful feature—but only for a few.
4. Earned income credit. The federal government, in its vigilant effort to simplify (?) things, has come up with a new complication: the earned income credit. While not commenting on its political or even economic impact, it is basically a program to allow those on the low end of the wage earning spectrum to receive funds in advance (i.e., an "earned income credit") on their income tax returns if they earn under $8,000. Most computerized payroll systems ignore this feature.
5. Automatic updating of general ledger. Somehow it seems to be a waste of many hours to again enter payroll information into the general ledger program. A good payroll system can eliminate this drudgery by providing output summaries which consolidated general ledger entry. Some advanced micro systems even set up disk files for program-to-program integration of the data.
6. Assistance schedules. Some payroll systems produce "mock timecards" and worksheets for employees. Fancy, even superfluous, but nonetheless often useful.
7. Personnel records. Many payroll systems have the beginnings of a good personnel records system. They maintain information about pay rate, of course, but can offer more—employee raise history, employee classification, etc. Of course, the usefulness of having this information in the payroll portion depends, to a large extent, upon the user's other systems.
8. One feature often overlooked is sick time and its impact upon FICA taxes. These are not payable on sick pay, and accordingly, a good payroll system should have the capability of accounting for this feature in the law. (This can be substantial, judging by the fact that many consulting firms make their fees exclusively from the analysis of company payrolls to find sick pay FICA). Unfortunately, I have yet to come across a micro system (other than my own) which takes this factor into account.
9. Sick time/vacation time. Besides being a necessary part of employment, sick time and vacation time accounting can save much paperwork and hassle in the accounting department. A good system will record dollars and hours of sick time and vacation time taken. An extraordinary system will account for time remaining (i.e. accrued time).
10. Union reports. Many industries, such as construction, require payroll-related reports for union or worker compensation. Unfortunately, these reports often do not correspond with month ends or other logical dates. The system should have the sophistication to handle these tasks.
11. Special withholding. Commissioned salespeople have a dislike for computer-generated paychecks, especially when the program withholds outrageous amounts on large, but infrequent, commissions. A good program will skirt this problem.

On to Datasmith

This is a collection of computer programs that perform all commonly required payroll functions. The system takes into account both hourly and salary pay, and will compute federal, state and local income taxes; it's capable of handling the EIC credits and a variety of other miscellaneous deductions such as loans. The system is provided in source code so changes are easily accomplished for customizations. In fact, the flow charts are among the most complete I have ever seen.

The requirements include at least 40K of memory, the Micropolis operating system, terminal, printer with at least 80 columns across and two disk drives.

The system is menu driven with clear explanations of what each option entails. There are nine auxiliary programs for data entry and calculation, reporting, updating and printing checks.

One of its interesting features is the introduction of "double keying" to reduce errors. Most of the payroll systems sold commercially utilize edit runs to determine that data entered is correct. The Datasmith program has the feature of entry of critical payroll information twice—a comparison is done as the data is entered and, as a result, at least keypunch errors can be reduced or eliminated.

The system is designed for "before the fact" payroll entry only, and only has limited provisions for entry of commissions or other types of "one-time" payrolls. It does, however, allow for up to five types of miscellaneous deductions.

The payroll method of calculation is somewhat rigid. Only two methods of paying employees are allowed—by the week for salaried employees and by the hour for hourly employees. Of course, a crafty user can get around these limitations and pay employees as needed. For example, a commission can be defined as a certain amount—say $350 per week and then the monthly commission of $1,400 will be calculated accurately.

One nice feature of the payroll system is the presence of a program which produces a "data input form." This makes data entry simple and organized, and is one of those little "special items" which, while not absolutely necessary, makes the system a little easier to use.

Anyone who has had to dredge through miles of unreadable computer garbage printout will appreciate Datasmith printouts. They are superbly organized and the payroll report, for one is among the best available in terms of readability. Unfortunately, only the current payroll and year-to-date figures are given. Department totals are given for gross payroll at the end of the list, but an employee can only be in one department. In other words, the system could be used for "production, clerical or management" but could not be used for job 10009, 19900, etc., where an employee worked on more than one job. □

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My story is only one example of how the FTC is harassing small businesses but I'm not going to sit back and take it.

By Joseph Sugarman,
President, JS&A Group, Inc.

I'm pretty lucky. When I started my business in my basement eight years ago, I had little more than an idea and a product.

The product was the pocket calculator. The idea was to sell it through advertisements in national magazines and newspapers.

Those first years in the basement weren't easy. But, we worked hard and through imaginative advertising and a dedicated staff, JS&A grew rapidly to become well recognized as an innovator in electronics and marketing.

THREE BLIZZARDS

In January of 1979, three major blizzards struck the Chicago area. The heaviest snowfall hit Northbrook, our village – just 20 miles north of Chicago.

Many of our employees were stranded – unable to get to our office where huge drifts made travel impossible. Not only were we unable to reach our office, but our computer totally broke down leaving us in even deeper trouble.

But we fought back. Our staff worked around the clock and on weekends. First, we processed orders manually. We also hired a group of computer specialists, rented outside computer time, employed a computer service bureau, and hired temporary help to feed this new computer network. We never gave up. Our totally dedicated staff and the patience of many of our customers helped us through the worst few months in our history. Although there were many customers who had to wait over 30 days for their parcels, every package was eventually shipped.

WE OPENED OUR DOORS

During this period, some of our customers called the FTC (Federal Trade Commission) to complain. We couldn't blame them. Despite our efforts to manually notify our customers of our delays, our computer was not functioning making the task extremely difficult.

The FTC advised JS&A of these complaints. To assure the FTC that we were a responsible company, we invited them to visit us. During their visit we showed them our computerized microfilm system which we use to back up every transaction. We showed them our new dual computer system (our main system and a backup system in case our main system ever failed again). And, we demonstrated how we were able to locate and trace every order. We were very cooperative, allowing them to look at every document they requested.

The FTC left. About one week later, they called and told us that they wanted us to pay a $100,000 penalty for not shipping our products within their 30-day rule. (The FTC rule states that anyone paying by check is entitled to have their purchase shipped within 30 days or they must be notified and given the option to cancel.)

NOT BY CONGRESS

The FTC rule is not a law nor a statute passed by Congress, but rather a rule created by the FTC to strengthen their enforcement powers. I always felt that the rule was intended to be used against companies that purposely took advantage of the consumer. Instead, it appears that the real violators, who often are too difficult to prosecute, get away while JS&A, a visible and highly respected company that pays taxes and has contributed to our free enterprise system, is singled out. I don't think that was the intent of the rule.

And when the FTC goes to court, they have the full resources of the US Government. Small, legitimate businesses haven't got a chance.

We're not perfect. We do make mistakes. But if we do make a mistake, we admit it, accept the responsibility, and then take whatever measures necessary to correct it. That's how we've built our reputation.

BLOW YOUR KNEE CAPS OFF

Our attorneys advised us to settle. As one attorney said, "It's like a bully pulling out a gun and saying, 'If you don't give me a nickel, I'll blow your knee caps off.'" They advised us that the government will subpoena thousands of documents to harass us and cause us great inconvenience. They warned us that even if we went to court and won, we would end up spending more in legal fees than if we settled.

To settle would mean to negotiate a fine and sign a consent decree. The FTC would then issue a press release publicizing their victory.

At first we tried to settle. We met with two young FTC attorneys and agreed in principle to pay consumers for any damages caused them. But there were practically no damages, just a temporary computer problem, some late shipments, and some bad weather. The FTC then issued a massive subpoena requesting documents that will take us months to gather and which we feel was designed to harass or force us to accept their original $100,000 settlement request.

Remember, the FTC publicizes their actions. And the higher the fine, the more the publicity and the more stature these two attorneys will have at the FTC.

If this all sounds like blackmail – that's just what it appeared to be to us.

We did ship our products late – something we've admitted to them and which we publicly admit here, but we refuse to be blackmailed into paying a huge fine at the expense of our company's reputation – something we've worked hard eight years to build.

We're not a big company and we realize it would be easier to settle now at any cost. But we're not. If this advertisement can attract the attention of Congressmen and Senators who have the power to stop the harassment of Americans by the FTC, then our efforts will be well spent.

ALL AMERICANS AFFECTED

Federal regulation and the whims of a few career-building bureaucrats is costing taxpayers millions, destroying our free enterprise system, affecting our productivity as a nation and as a result is lowering everybody's standard of living.

I urge Congressmen, Senators, businessmen and above all, the consumer to support legislation to take the powers of the FTC from the hands of a few unelected officials and bring them back to Congress and the people.

I will be running this advertisement in hundreds of magazines and newspapers during the coming months. I'm not asking for contributions to support my effort as this is my battle, but I do urge you to send this advertisement to your Congressmen and Senators. That's how you can help.

America was built on the free enterprise system. Today, the FTC is undermining this system. Freedom is not something that can be taken for granted and you often must fight for what you believe. I'm prepared to lead that fight. Please help me.

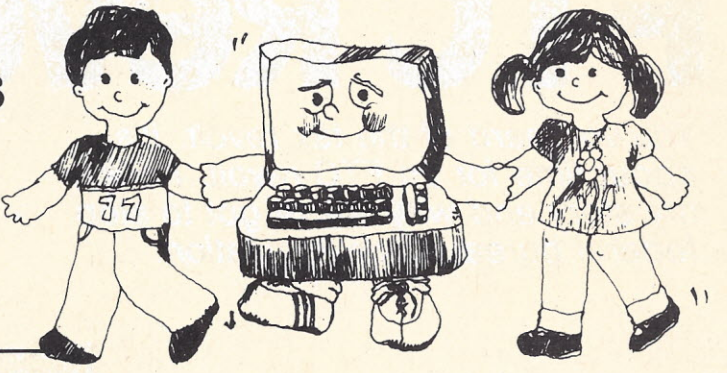
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My TRS-80 Likes Me

When I Teach Kids How to Use It

by Bob Albrecht



Wandering Star Gets Your Help

As you watch Wandering Star meander about the cosmic oasis, do you ever wish you could help in her quest for cosmic dust? With the following program, you can. However, the universe also has cosmic noise (ask your local astrophysicist). So Wandering Star does not always hear when you try to help her.

```
100 REM***WANDERING STAR #3
110 CLS

200 REM***COSMIC DUST
210 FOR K=1 TO 200
220 PRINT @ RND(1022), ".";
230 NEXT K

300 REM***WANDERING STAR APPEARS
310 ROW=7
320 COL=32
330 PRINT @(64*ROW + COL), "*";

400 REM***WANDERING STAR RESTS
410 T=2000
420 FOR Z=1 TO T : NEXT Z

500 REM***DOES SHE HEAR US?
510 P=50
520 IF RND(100)<=P THEN GOSUB 710 ELSE
    GOSUB 810

600 REM***SHOW HER IN HER NEW PLACE
610 PRINT @(64*ROW+COL), "*";
620 T=100
630 FOR Z=1 TO T : NEXT Z
640 GOTO 510

700 REM***SUBROUTINE. SHE HEARS US!
710 PRINT @(64*ROW+COL), " ";
720 K$=INKEY$
730 IF K$="D" THEN ROW=ROW+1
740 IF K$="U" THEN ROW=ROW-1
750 IF K$="R" THEN COL=COL+1
760 IF K$="L" THEN COL=COL-1
770 RETURN

800 REM***SUBROUTINE. SHE DIDN'T HEAR US
810 PRINT @(64*ROW+COL), " ";
820 W=RND(4)
830 IF W=1 THEN ROW=ROW+1
840 IF W=2 THEN ROW=ROW-1
850 IF W=3 THEN COL=COL+1
860 IF W=4 THEN COL=COL-1
870 RETURN

999 END
```

When you 'run' this program, press keys to tell Wandering Star to go down, up, right or left. Guide her towards cosmic dust.

- Press D to go down
- Press U to go up
- Press R to go right
- Press L to go left

She might hear you, or she might not. This happens in lines 510 and 520. In line 510, we have set P equal to 50. This will cause Wandering Star to hear you about 50% of the time. If you change P to 30, she will hear you about 30% of the time. Try 70. She will hear you about 70% of the time. If you change P to 100, she will hear you all the time. Do an experiment, try lots of different values for P in line 510.

The value of P is the probability (in percent) that Wandering Star will go in the direction of your key press (D, U, R or L). Why? Well, let's look at line 520.

```
520 IF RND(100)<=P THEN GOSUB 710 ELSE
    GOSUB 810
```

RND(100) is a random integer in the range 1 to 100. Suppose P = 50. About 50% of the time, RND(100) will be less than or equal to 50. In this case, the condition RND(100?<=P is true and the TRS-80 will 'gosub 710.' About 50% of the time, RND(100) will be greater than 50 and the condition RND(100)<=P will be false. In this case, the TRS-80 will obey the 'else' clause and 'gosub 810.'

This program does not prevent Wandering Star from trying to wander off the screen. How can you help keep her on the screen, moving towards delicious cosmic dust? Also, how can we make Wandering Star's diet more interesting? After all, would you like to eat cosmic dust for millions of years?

Gamemaster's Dice

Last time, we showed you a short program to create an adventurer for the game of Runequest. We could easily modify that program to create a Dungeons and Dragons character or a Tunnels and Trolls character.

Instead, let's write one program to create a character in any of the three game systems. The following table shows the names of attributes in the three systems. We also show the abbreviations for each attribute in parentheses.

DD	RQ	TT
Strength (STR)	Strength (STR)	Strength (STR)
Intelligence (INT)	Intelligence (INT)	Intelligence (IQ)
Wisdom (WIS)	Power (POW)	Luck (LK)
Constitution (CON)	Constitution (CON)	Constitution (CON)
Dexterity (DEX)	Dexterity (DEX)	Dexterity (DEX)
Charisma (CHA)	Charisma (CHA)	Charisma (CHA)
	Size (SIZ)	

OK, let's do this program, piece by piece. We begin like this.

```
100 REM***CREATE A FANTASY CHARACTER FOR
120 REM***DD, RQ OR TT
130 REM***SET UP ATTRIBUTE STRINGS
140 DD$ = " 6 STR INT WIS CON DEX CHA "
150 RQ$ = " 7 STR INT POW CON DEX CHA SIZ "
160 TT$ = " 6 STR IQ LK CON DEX CHR "
```

In lines 140 through 160, each string contains the number of attributes and the abbreviations for the attributes for one type of game. Within each string, we use exactly four positions to hold each individual substring. For example,

```
150 TT$ = " 6 STR IQ LK CON DEX CHR "
          |___|___|__|___|___|___|___|
          4 places  4 places  . . .  4 places
```

So, STR begins at character position 5, IQ begins at character position 9, LK begins at 13, and so on.

```
150 TT$ = " 6 STR IQ LK CON DEX CHR "
          ↑   ↑   ↑  ↑  ↑   ↑   ↑
          1   5   9  13 17  21  25   Character position
```

OK, let's move on.

```
200 REM***TELL ABOUT THE PROGRAM
210 CLS
220 PRINT "I CAN CREATE A CHARACTER FOR"
230 PRINT
240 PRINT " DUNGEONS AND DRAGONS  (DD)"
250 PRINT " RUNEQUEST             (RQ)"
260 PRINT " TUNNELS AND TROLLS    (TT)"
270 PRINT
280 INPUT "WHICH DO YOU WANT (DD, RQ, OR
    TT)"; GAME$
```

We now expect someone to enter DD, RQ or TT. If anything else is entered, we will start over.

```
300 REM***CHECK OUT THE VALUE OF GAME$
310 IF GAME$ = "DD" THEN AT$ = DD$ : GOTO 410
320 IF GAME$ = "RQ" THEN AT$ = RQ$ : GOTO 410
330 IF GAME$ = "TT" THEN AT$ = TT$ : GOTO 410
340 PRINT "I DON'T UNDERSTAND" GAME$ :
    GOTO 270
```

If someone enters DD, RQ or TT, the TRS-80 moves on to line 410 after first setting AT$ to the appropriate attribute string. If something other than DD, RQ or TT is entered, the TRS-80 says it doesn't understand and repeats the question.

So let's see what happens next.

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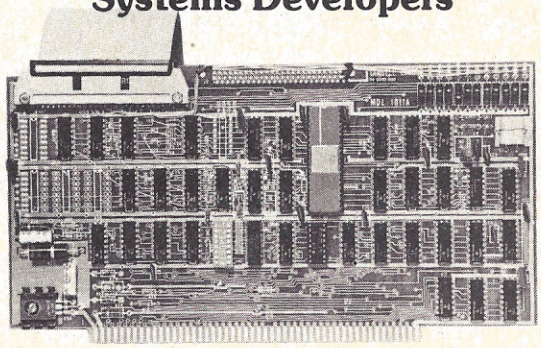
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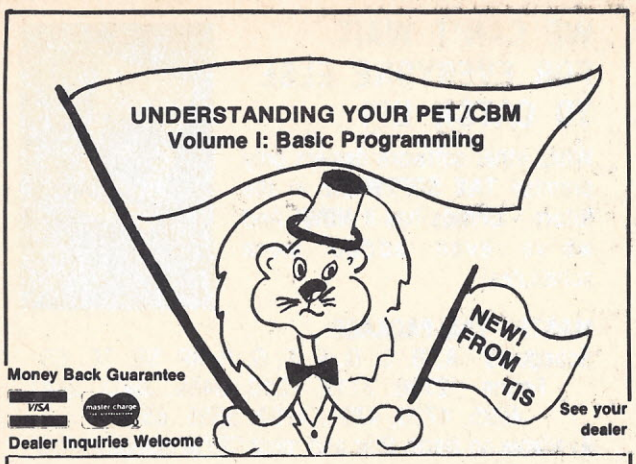


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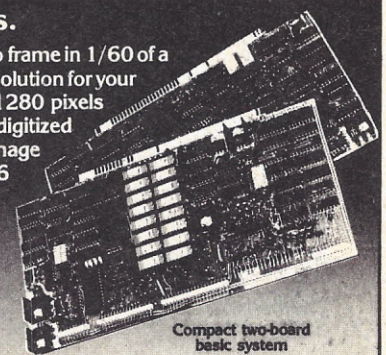
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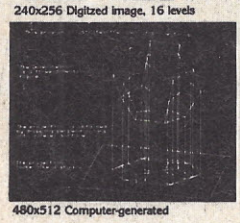
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```
400 REM***ROLL THE CHARACTER
410 NQ$ = LEFT$(AT$, 4)
420 NA = VAL(NA$)
430 FOR K = 1 TO NA
440   AT = 4*K + 1
450   DICE = RND(6) + RND(6) + RND(6)
460   PRINT MID$(AT$, AT, 4), DICE
470 NEXT K
```

Your turn. You figure out how this piece of the program works. Next time, we will tell you our version of how and why it works. In the meantime. . .

```
500 REM***ASK IF SOMEONE WANTS ANOTHER
    CHARACTER
510 PRINT
520 PRINT "FOR ANOTHER CHARACTER, PRESS
    THE SPACE BAR";
530 K$ = INKEY$ : IF K$ = "" THEN 530
540 IF K$ = " " THEN 210 ELSE 530

999 END
```

Your turn, again. Suppose we change lines 140 through 160, as follows.

```
140 DD$ = "STR INT WIS   CON DEX CHA"
150 RQ$ = "STR INT POW CON DEX CHA SIZ"
160 TT$ = "STR IQ   LK    CON DEX CHR"
```

How would you change the rest of the program so it still works as before?

We are going to do lots more Gamemaster's Dice stuff. So we encourage you to get the rulebooks for DD, RQ and TT.

- *Dungeons and Dragons* (DD) from TSR Hobbies, P.O. Box 756, Lake Geneva, WI 53147
- *Runequest* (RQ) from The Chaosium, P.O. Box 6302, Albany, CA 94706
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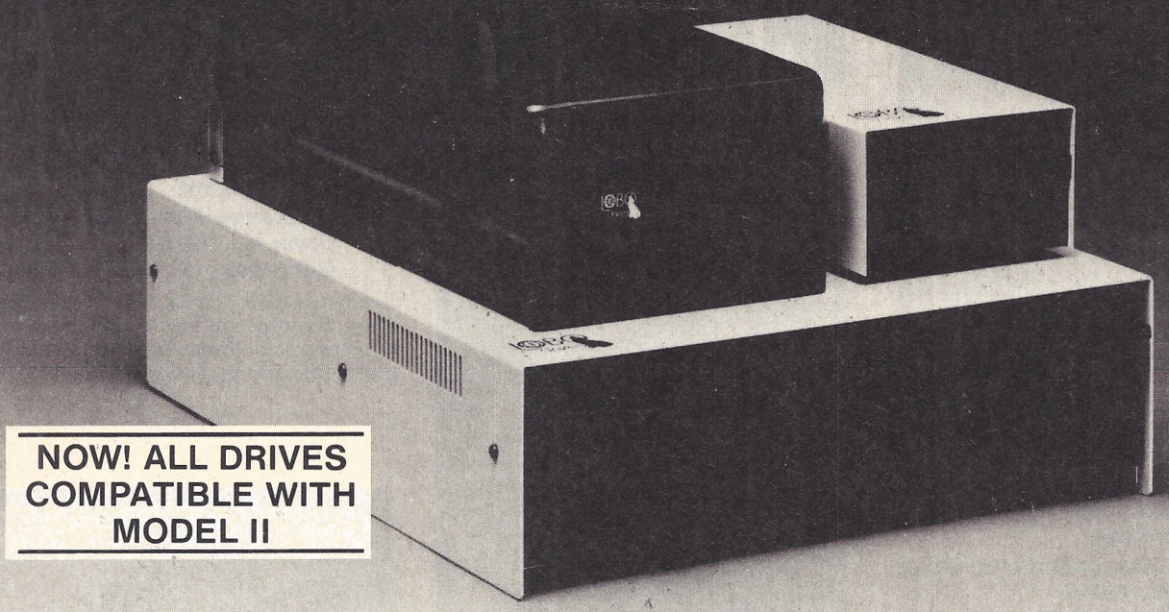
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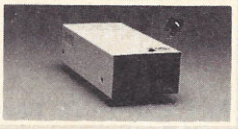
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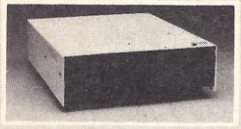
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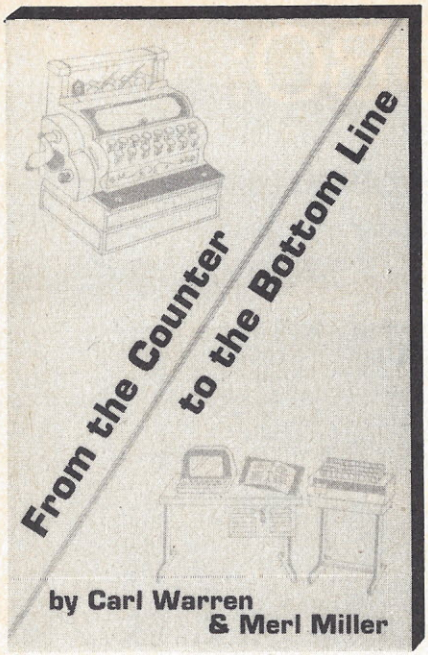
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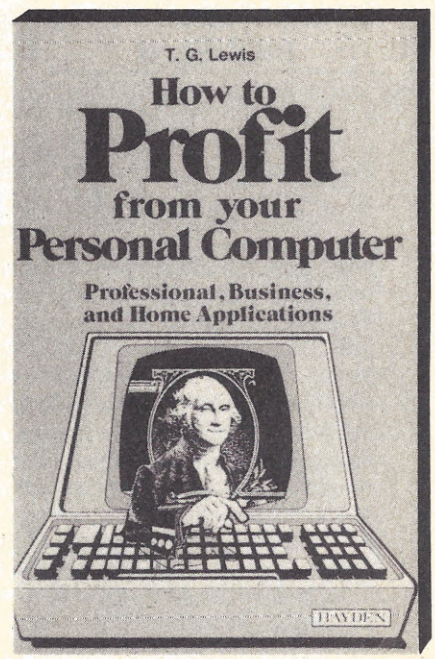
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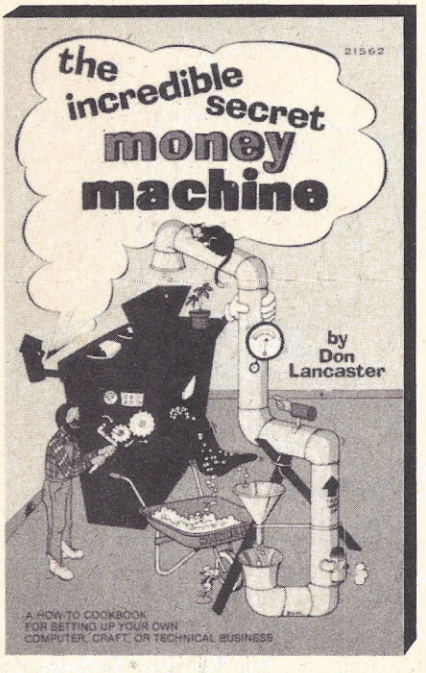
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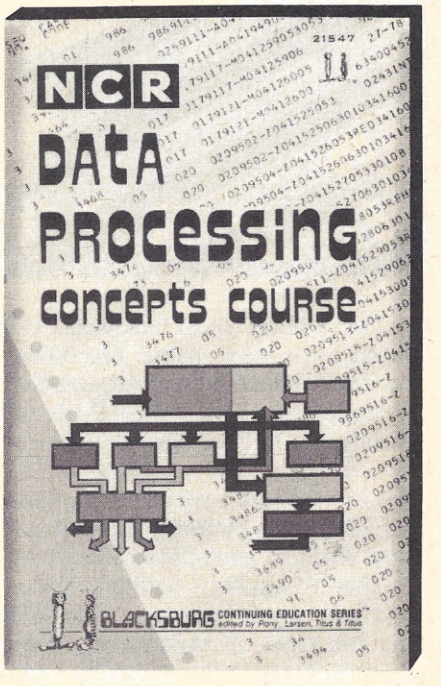
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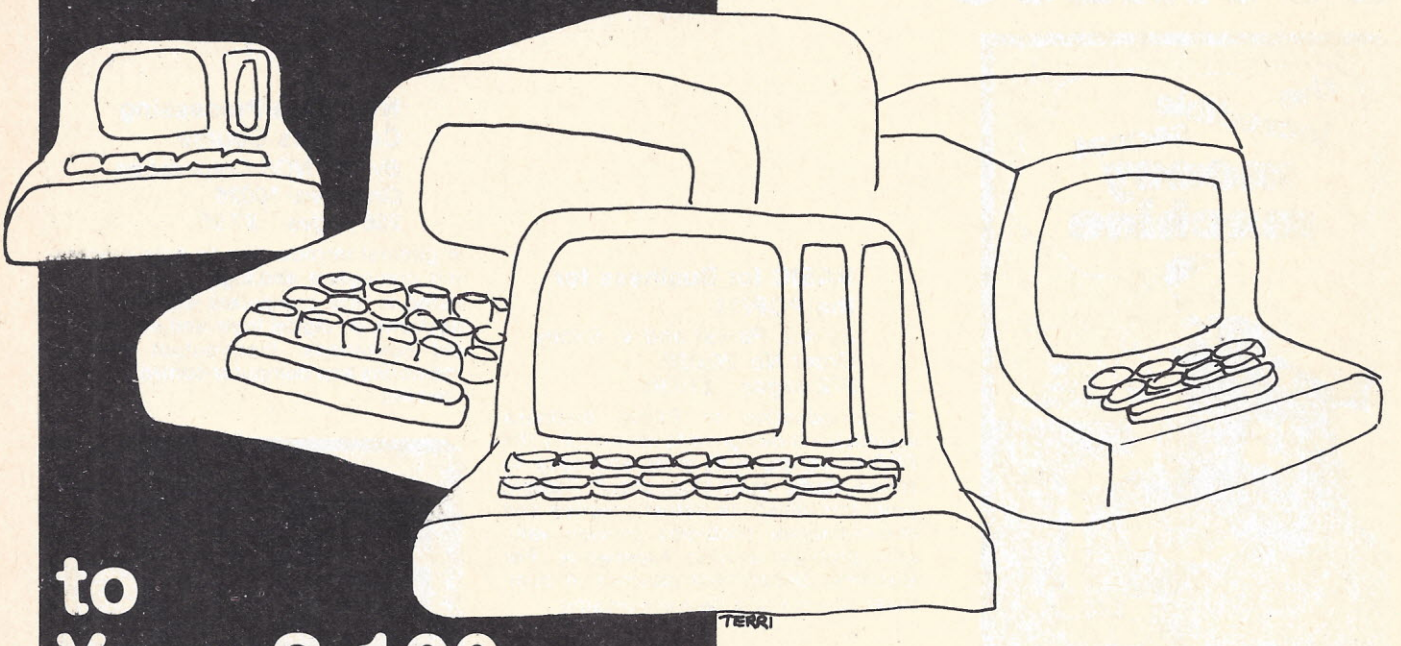
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Hardware Review

Add A Terminal —and More— to Your S-100



by Roger Edelson

The Matrox 2480 family of TV CRT controllers provides a low-cost viable alternative to a separate CRT terminal. This family allows the S-100 bus user to add a professional, full-featured, 24 line by 80 character video display to his system with virtually no operational penalty. The S-100 bus compatible ALTR-2480 uses a transparent memory feature to eliminate the display interference/streaking effects caused by the memory contention problem associated with many video displays.

The transparent memory (actually a double-ranked 4K by 8 static memory) eliminates this simultaneous access type of interference without resorting to the complexities of DMA and/or vertical-blanking access synchronization. With this design, the CPU may access the dynamic memory at any time and the implementation is not sensitive to CPU timing characteristics. This multiplexed-memory design permits non-contentious access by both the CRT controller and the CPU with no on-screen interference or CPU interrupts and synchronization delays.

Versatile Lettering, Customized Fonts

The Matrox 2480 provides full upper and lower case characters as well as simple graphic symbols. The character generator is a 2K by 8 (2716) Eprom programmed by Matrox but, if desired, the user may easily incorporate custom fonts. The character set available in the standard Matrox programmed character generator ROM (MCH-001) is shown in figure 1. The 2K x 8 character-space allows the formation of 128 characters, adequate for almost any requirement. As supplied, the standard character generator contains the full Ascii alphabet set plus 32 graphics based on a font designed for a 6 x 10 cell, though provision has been made for an optional 8 x 10 cell.

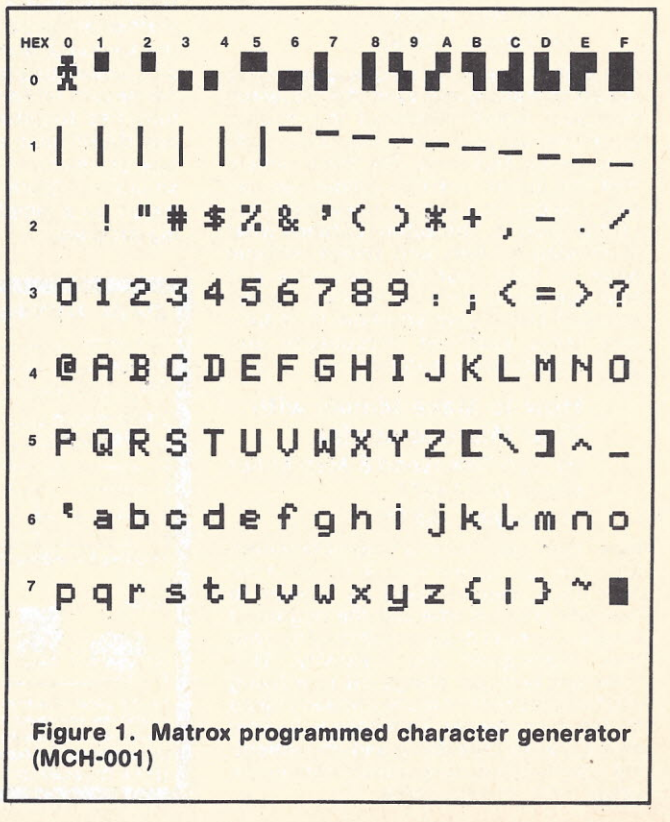


Figure 1. Matrox programmed character generator (MCH-001)

The Eprom pin assignments and the character position within the cell are shown in figure 2. Note that row 0 is blank as is normal to allow for intercharacter spacing. Rows 8 and 9 are used to display the descenders of lower case characters. The graphic characters use all the rows, even those normally reserved for spaces, to allow for the drawing of continuous lines.

When the ALTR-2480 is set up for a 6 x 10 cell size, outputs 1 and 2 are not visible. The use of a 6 x 10 cell with lower case descenders produces a crisp, readable display.

	PIN	FUNCTION	
01	9		Character outputs which
02	10		form a horizontal slice
03	11		through the character.
04	13		
05	14		
06	15		
07	16		
08	17		
A0	8	Row Select 0	Select one of 10
A1	7	Row Select 1	horizontal slices
A2	6	Row Select 2	through character
A10	TI20/Intel 19	Row Select 3	cell.
A3	5	D0 LSB	
A4	4	D1	Selects one of 128
A5	3	D2	characters from the
A6	2	D3	character generator.
A7	1	D4	These lines are connected
A8	23	D5	to the data bus lines
A9	22	D6 MSB	indicated.

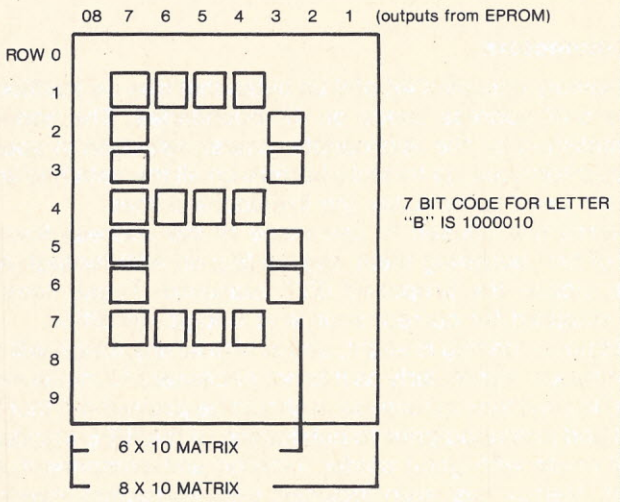


Figure 2. Eprom pin assignments

European/American Interface

The addressing, and screen organization for the 24 x 80 format, is shown in figure 3. The ALTR-2480 display interface may also be optionally jumpered for a 2 page 24 x 40 character format if this style is more to the user's liking. The board may be configured for either the American TV (60 Hz) non-interlaced standard or for the European 50 Hz. In either mode, the ALTR-2480 will work with any standard TV monitor or modified TV with at least a 10 MHz bandwidth.

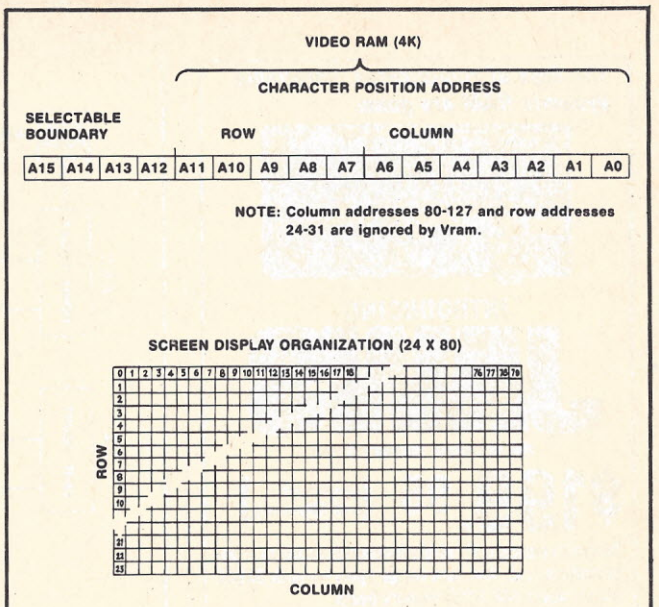


Figure 3. Addressing the ALTR-2480 for a 24 x 80 organization.

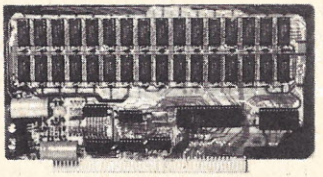
The board provides a 75-ohm composite video output which will drive up to 10 monitors for a combined distance of 500 feet. The video timing is crystal controlled by an on-board xtal oscillator and the video output is TTL. For the standard 6 x 10 cell size, the crystal is 11.06688 MHz and is necessary to obtain a 14.75584 MHz crystal for the 8 x 10 cell format. No crystal change is required when switching from American to European bands.

In keeping with the specification for a professional alphanumeric display, the ALTR-2480 provides software control for character blink, inverse video, or normal intensity. The board is also compatible with either the Matrox 256 or 512 graphics interface families for a powerful combined alphanumeric graphic display. The interconnection of the two boards can be done with a simple 4-wire cable interface.

The block diagram of the ALTR-2480 is shown in figure 4; the alphanumeric display consists of video counters and timing circuitry, a 4K x 8 static RAM, address multiplexing, and a ROM character generator driving the video generator. All this circuitry is connected to the S-100 bus through appropriate interface circuitry. The sync generator consists of a, by now standard, double gate crystal oscillator followed by a string of counters. Three LS163s produce the horizontal count while an LS390 and LS393 suffice for the vertical count. A variety of gates turns the horizontal and vertical counts into the requisite video sync signals. The dividers also produce the required timing signals for memory scanning.

The double-ranked memory consists of four 2114 4K static memory ICs. The memory access time is 500 nsec. The memories are multiplexed through three quad 2-to-1 line multiplexer circuits and some address steering gates which control the chip-selects on the memory ICs. The data output of the memory, as controlled by the scan circuitry, determines the output of the character generator ROM. The PROM output is byte loaded into a parallel-to-serial shift register and then clocked into the video generator under control of the horizontal and vertical timing circuits.

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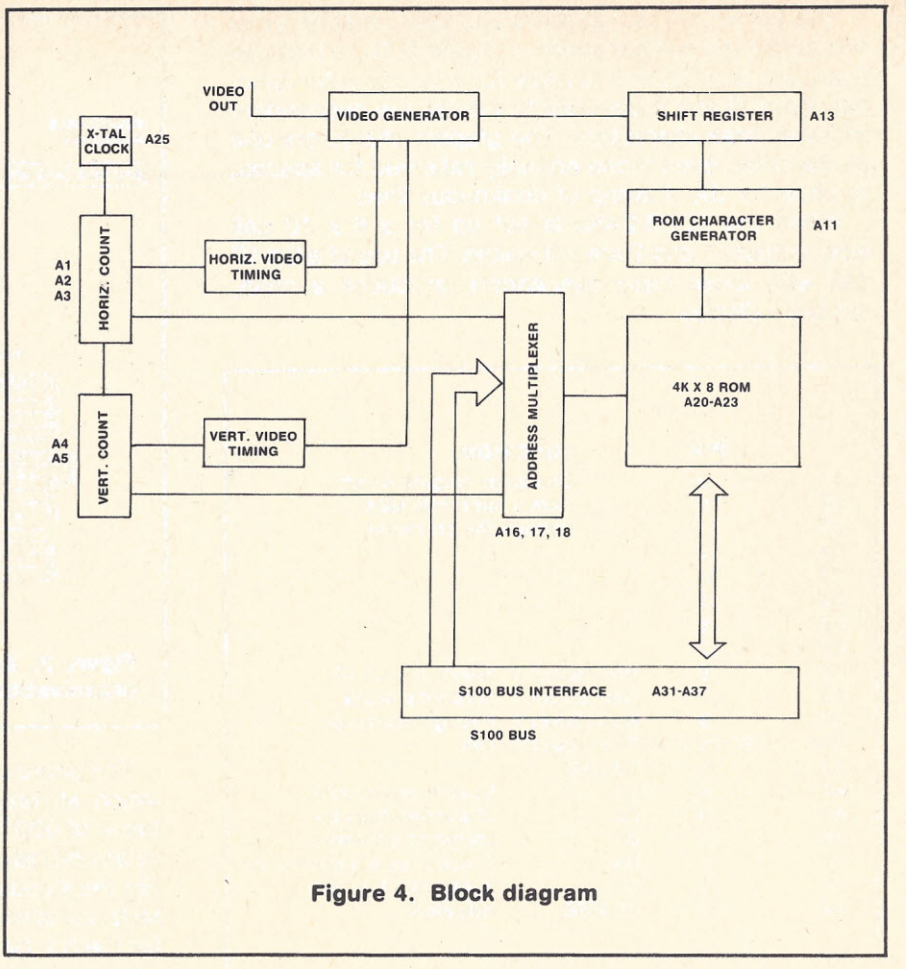


Figure 4. Block diagram

Tri-state Buffer Connectors

The ALTR-2480 memory occupies 4K of 8 bit bytes that may be positioned anywhere within the 64K address space on 4K boundaries. The address positioning is accomplished by the appropriate jumper selection in socket S1. The board is fully interfaced via tri-state buffers on all the data bus lines and the data selectors used to multiplex the low-address lines.

Unfortunately, Matrox has chosen to use some of the address lines in multiple areas without first buffering them, the loading on A12 through A15 and A4, A5 and A6 violate the proposed IEEE standard. These lines all slightly exceed the standard for current source at 0 logic condition.

The amount of additional loading is slight, and in almost any usage will not affect system performance, particularly as it is not necessary to install more than one ALTR-2480 in a system. In fairness, it should be pointed out that the board was designed and produced prior to publication of the IEEE standard.

The board is well made with good solder masking and component and jumper identification. Matrox has even included card extraction levers (a nice touch). A socket has been provided for the character generator to enable easy user interchangeability. The device supplied is a preprogrammed ROM but can handle a customized 2716 Eprom if a different character set is desired. Unfortunately, Matrox has chosen not to provide sockets for the 2114 static RAMs, probably the most likely components to fail. The board requires only a single +8 v supply at .8 amps and is designed to be fully compatible with S-100 timing and bus assignments. The ALTR-2480 is only available fully assembled, tested and burned-in.

A software package is available which provides the user with the full flexibility of a software driven video display with the implementation ease of a stand-alone terminal. The package, as supplied, will fully emulate the LSI ADM-3A or DEC VT-52 interactive terminals. A line at a time and a text block input modes are available to allow the powerful text preparation features of an intelligent terminal. The package supports three input modes from the simplest, full duplex through half-duplex (line-at-a-time) to block mode—for text editing. ☐

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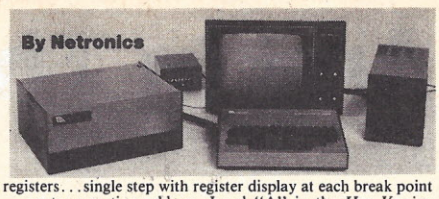


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PC Board: glass epoxy, plated through holes with solder mask • **I/O:** provisions for 25-pin (DB25) connector for terminal serial I/O, which can also support a paper tape reader ...provision for 24-pin DIP socket for hex keyboard/display...cassette tape recorder input...cassette tape recorder output...cassette tape control output...speaker output... LED output indicator on SOD (serial output) line...printer interface (less drivers)...total of four 8-bit plus one 6-bit I/O ports • **Crystal Frequency:** 6.144 MHz • **Control Switches:** reset and user (RST 7.5) interrupt...additional provisions for RST 5.5, 6.5 and TRAP interrupts onboard • **Counter/Timer:** programmable, 14-bit binary • **System RAM:** 256 bytes located at F8ØØ, ideal for smaller systems and for use as an isolated stack area in expanded systems...RAM expandable to 64k via S-100 bus or 4K on motherboard.

System Monitor (Terminal Version): 2k bytes of deluxe system monitor ROM located at FØØØ leaving ØØØØ free for user RAM/ROM. Features include tape load with labeling ...tape dump with labeling...examine/change contents of memory ...insert data...warm start...examine and change all registers...single step with register display at each break point, a debugging/training feature...go to execution address... move blocks of memory from one location to another...fill blocks of memory with a constant...display blocks of memory ...automatic baud rate selection...variable display line length control (1-255 characters/line)...channelized I/O monitor routine with 8-bit parallel output for high speed printer... serial console in and console out channel so that monitor can communicate with I/O ports.

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registers...single step with register display at each break point ...go to execution address. Level "A" in the *Hex Version* makes a perfect controller for industrial applications and can be programmed using the Netronics Hex Keypad/Display.



Hex Keypad/Display.

Hex Keypad/Display Specifications

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Level "B" Specifications

Level"B" provides the S-100 signals plus buffers/drivers to support up to six S-100 bus boards and includes: address decoding for onboard 4k RAM expansion select-able in 4k blocks...address decoding for onboard 8k EPROM expansion selectable in 8k blocks...address and data bus drivers for onboard expansion...wait state generator (jumper selectable), to allow the use of slower memories...two separate 5 volt regulators.



Explorer/85 with Level "C" card cage.

Level "C" Specifications

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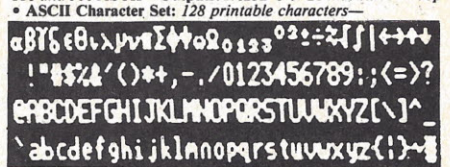
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BAUDOT Character Set: *A B C D E F G H I J K L M N O P Q R S T U V W X Y Z - ? : * 3 $ # () . , 9 0 1 4 1 5 7 ; 2 / 6 8* • **Cursor Modes:** *Home, Backspace, Horizontal Tab, Line Feed, Vertical Tab, Carriage Return. Two special cursor sequences are provided for absolute and relative X-Y cursor addressing* • **Cursor Control:** *Erase, End of Line, Erase of Screen, Form Feed, Delete* • **Monitor Operation:** *50 or 60Hz (jumper selectable.*

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And In This Corner...



The Information Analyst

by Frank Vaughan

One of the brightest debuts at the National Computer Conference in Anaheim this year was the Apple III small business system.

Apple went to great pains to show off its stuff at the annual gathering. . .renting all of Disneyland for a night (at a reported cost of $42,000). . .bussing visitors in a British two-decker. . .and unveiling the soon-to-be-famous Apple III.

The soon-to-be-famous Apple III? Yes, because as nearly as we can tell, all of the faults found with the Apple II seem to have been corrected in the Apple III. Don't be mistaken: this machine is not in the "game" category. This is a pure business system. . .no game paddles or color TV set. Here is a minimum 96K system with a professional Hitachi black and white monitor that is as crisp in its display as the previously shipped color televisions were fuzzy. Here also is the new operating system which some punster labeled "Apple SOS" or "applesauce."

Hardware is still based on the 6502, which has been cranked up to 2 MHz. Now, 2 MHz isn't too impressive, but if you recall, an Apple II using the same chip at 1 MHz often equals some of the 4 MHz systems. Since we only tested the system for one morning, time did not permit us to run any timing activities, but we expect that the system will provide more than 2 MHz performance.

Prices will run from $4,340 to $7,800, which makes it a reasonably priced small business system. The pricing holds the key to Apple's marketing plans for this system, as there are no indications that Apple plans to sell the new device in less than full system configurations.

The minimum system is called the Information Analyst and consists of a 96K CPU with a single built-in floppy drive, the improved keyboard (which still isn't detachable but is used to hide the sister boards with all the memory), two printer interfaces and a 12-inch video monitor. Software will include Apple SOS, and a management oriented set of software tools which includes Visicalc III, a mail list manager and Apple Business Basic.

For the word processor system, Apple adds an external disk drive and a choice of two printers, the surprisingly good Apple Silentype thermal unit, or a letter-quality daisywheel. The system with a Silentype is $5,330; switching to the daisywheel jacks the price up to $7,800. Software for the system, regardless of printer, includes SOS and word processing application software. A training course is also included.

Options include 32K of additional RAM, bringing the system to a 128K maximum, additional floppies to a maximum of four, the use of NTSC or RGB color video monitors, various I/O cards and a vinyl carrying case for those inclined to compute on the road.

Highlights and Contrasts

- The Apple III is an upper and lower case machine that will allow the user to mix text and graphics. The actual character set is stored in RAM, not ROM, which allows for a user-defined character set, special symbols and graphics.
- A battery-powered integral clock and calendar retain time and date references even when the system is powered down. The function can be used to automatically time- and date-stamp file entries.
- When the system is first powered up, it automatically performs some ROM-based hardware diagnostics and then self-boots. Apple will eventually publish, or make available, some limited troubleshooting information.
- Like the Apple II, this system uses single-sided, single-density 5¼-inch floppy disks. Unlike the Apple II, the disks are 16 sectored, not 13, which gives users some 23% more storage capacity per disk.
- SOS contains an emulation mode which disables all of the Apple III special functions and allows the system to function as an Apple II.
- A new DOS for the Apple II users will be released under the label of DOS 3.3. Basically, it is the Apple II DOS modified to run 16 sectored disks. It will be distributed with two ROM chips that will go on the disk controller card and make the disk recognize 16 sectors.
- DOS 3.3 will contain a utility called "muffin" that will allow users to convert data on 13 sectored disks to 16 sectored disks. Officials at Apple anticipate that the only difficulties that users might encounter would be with protected disks.
- Newly built Apple II systems will be distributed with DOS 3.3. For those interested in upgrading, the new OS will cost $60, which includes the code, two ROMs and manuals.
- Sources inside Apple indicate that SOS is patterned after the highly successful UNIX operating system from DEC.
- An additional DOS 3.3 feature will be a file transfer system "FID" that allows users to transfer files by name only.

Looking at Applesauce

The Apple SOS consists of five major elements: a device independent file system, which is byte oriented and interrupt-driven and controls the storage elements of the system; a device module, which handles devices that are either block- or character-oriented; an event manager, which associates interrupts with the activities of an outside source; a memory management system that lets programs run anywhere there is sufficient memory, reportedly making the process user-transparent; and a system call manager, which receives and processes SOS calls from running applications, decodes and sends them to the proper SOS module.

According to Apple, the SOS overlays directly on the system hardware, providing an interface to all system elements and isolating their operating details from the user. SOS will act as a foundation on which language development modules are set, so that the user can enjoy the interchangeable use of multiple languages.

In a separate announcement, Apple introduced an ANSI standard Fortran, called Apple Fortran, which is a subset of Fortran 77. It differs from the ANSI subset in that: compiler directives may be included in source code, subprogram names cannot be passed as parameters, and integer- and real-data types have different storage requirements—two- and four-bytes respectively. The new Fortran will be available in the third quarter and will cost $200. It is announced on the Apple II only, but indications are that it will also run on the Apple III.

Hardware Notes

The system will probably draw much of its power from its CPU utilization, which features a superset of the 6502 instruction set, relocatable base page register, relocatable stack and 128K byte address range.

Peripheral devices will request machine attention via either interrupt or polling methods. It has a built-in 6-bit digital-to-analog converter. While the company has absolutely no plans to offer game paddles—a single joystick for analog input is planned.

An expanded keyboard with 74 keys is also included, featuring sculptured keys for a typewriter-like feel, numeric pad, two function keys and an alpha lock key. Auto repeat is featured on all keys.

The previous optional disk controller is now built in and can handle up to four drives. Both serial and RS-232-C ports are provided for the printers.

Three different text modes are provided. It supports 80-character upper/lower case text with true descenders, 40-character black and white text or use when in the Apple II emulation mode and 40-character color-on-color text. Graphics modes include 560 by 192 black and white and 280 by 192 16-color, which may also be used for 16 shades of grey.

The system has four I/O slots available for additional expansion. Additional boards to be available will include: a parallel printer card, an analog interface card and an engineering development card. □

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A Home for Your Computer

by Tom Fox

Remember the feeling of exhilaration you experienced when you hired your first employee? In one swoop, you doubled the size of the work force and dissipated the burden of performing tedious, routine tasks yourself.

But it was also up to you to make sure that the employee was happy in the new work place. So you took special pains to make sure the work area was comfortable, a parking space was available, the coffee was hot and fresh.

The same attitude and attention should be present when you bring a computer into your organization for the first time. Computers are a special . . .fussy kind of appliance: remarkably capable, but requiring a specific type of environment. Here is some idea of what it should be like—and how to go about it.

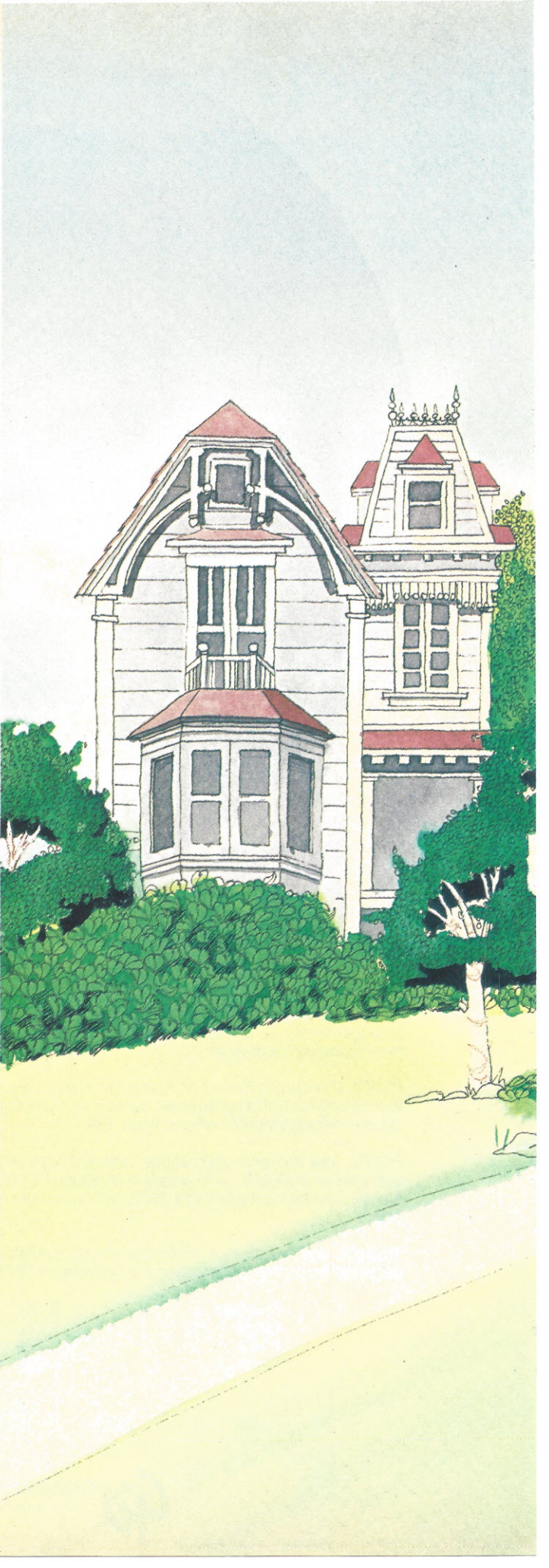
Where To Put It

Several considerations are important: the system's accessibility to users, the quality of electrical power to feed it, temperature and cleanliness of the surrounding air, ease of maintenance, isolation from those who shouldn't be fooling around with it. If you can, set it up in its own room, convenient to those who will be working with it. Resist the temptation to squeeze it on a desk top simply because it will "just fit there." Paraphernalia tend to accumulate around a computer: instruction manuals, computer-generated reports, data disks, etc. This is important to the machine's operation, but it can take up more floor and desktop space than the computer itself.

If you replace your secretary's typewriter with a word processing computer that "just fits," you will witness a phenomena having the characteristics of crabgrass: it will silently and insidiously stake a claim on every bit of table top, chair and floor space in reach. Before long, your secretary will lose complete control of her territory, and have to look elsewhere to perform her job. You've heard of people being replaced by a computer, but this is ridiculous.

Another reason for placing the system in its own room is to control who has access to it. Even the best-intended friend or trusted employee can be destructive in computerdom. A closed door easily removes the temptation.

The same thing applies double to data, the information about your business that you give to the computer, and is returned to you in digested form. Data will generally be kept on disks or floppy diskettes which can exceed the value of the computer —and are far more fragile.




FINO

What To Feed It

Most of today's computers will operate on the voltages and power ratings commonly found in offices. Nearly all new business machines work with 117 volts AC, 60 hertz, single phase, at a current rating of less than 15 amps per unit. There is a catch, however. Computers tend to be fussy about the *quality* of power they receive. Voltage should not vary more than ±10% from 117 volts. If your office lights dim or flicker when the air conditioner cycles on, a small computer won't work until the power is stabilized.

Why are computers so particular about power? Because they work in tiny steps to solve gigantic problems. Since the steps are small, they must be performed extremely rapidly: recently-built computers perform at least one million operations per second; many work at five times that rate. That's over 80,000 computations for each cycle of 60 hertz AC power. Can you imagine the havoc to a paycheck-writing program if power were disturbed for a single cycle, and the CPU "forgets" to perform thousands of instructions?

To find a solution to a power problem, we have to understand what sort of things cause them. Summertime city-wide brownouts are becoming all too familiar. A brownout is the deliberate reduction in voltage instigated by power company engineers to protect their generating systems from overload. A computer not specially protected against a sustained reduction in voltage should be turned off until the crisis passes.

Another problem is interference by outside influences: a nearby television or radio tower, a diathermy machine in the doctor's office next door, even a defective CB radio in the neighborhood. This sort of problem is even more difficult to solve, but fortunately it's relatively rare.

A final thing to watch for is the effect the computer can have on itself. Disk drives, particularly for hard disk media, require a healthy surge of current to get them started. This momentary demand can cause problems in another portion of the system for a few seconds. Power that checks out perfectly prior to a computer installation can easily become marginal because a computer is connected to it. It's one of the computer world's catch-22s: the electricity is just great—until you start to use it.

What can you do? Begin by making sure that nothing else under your control is robbing juice from the circuit. Hire an electrician to make sure this power comes from the breaker panel or other main distribution point; that the computer's circuit is not shared by other appliances or wired-in equipment such as furnace blowers or air conditioners.

Have the electrician accurately measure the voltage. It should be within 5 volts of 117 volts AC. Watch the voltmeter carefully for 10 minutes to make sure it stays within this range, preferably in mid-afternoon when power consumption is highest. Meanwhile, have someone turn all large appliances on and off. This won't catch all possible power problems, but it's a start. If some adverse condition is spotted, call in the power company. Chronically low voltage can often be fixed by changing a tap on the transformer.

Power surges caused by equipment in nearby businesses are more difficult to stop. In extreme cases, the power company may have to run a separate line to your building from their substation—but not for free. A power company's standard for "satisfactory power" is almost always below what is necessary for trouble-free computer operation.

What Now?

To begin with, every component in a computer system has minimal built-in protection against substandard power. Certain computers have a great deal of such protection; it is one of the things to look for when shopping for equipment.

Get a list of the voltage range for each unit and find out the maximum current needed for all operating conditions. Show this to your electrician to get a judgment as to the adequacy of power—at least on paper. If the ultimate solution—installing a piece of equipment to boost inferior power regardless of outside influences—becomes necessary, here are the four basic categories:

Line isolators are transformer-like devices that filter out spurious signals such as radio and TV interference, voltage spikes and momentary dropouts. They cost from $100 to $300.

Power that checks out perfectly prior to a computer installation can become marginal because a computer is connected to it.

Line regulators are boxes that actually boost voltage when it falls too low and cut it when it gets too high, so it always stays within a healthy narrow region. This costs from $300 to $600.

Capabilities of both isolators and regulators are available in a device called a power conditioner. It will accept from 87 to 135 volts from the powerline and delivery within 7% of 117 volts to the computer. It will reduce spurious signals to one 10-millionth of their original value before the computer sees them. The cost for this device is in the $400 to $700 range.

Finally, we have no-break power systems, sometimes called uninterruptible power systems. This is the top of the line (and priced accordingly). They will handle everything the above units will, and continue to feed pure voltages even after the lights go out. Massive batteries keep the computer going during brownouts and blackouts. Because of their prohibitive cost, no-break power systems are installed only when absolutely

necessary. If you need this type of protection, plan on spending from $2 to $5 a watt—at least $2000 for a very small computer.

The Air It Breathes

Computers require air mainly for cooling purposes. Modern small business computers usually operate with no difficulties if the room is kept at normal room temperature. But don't leave it at that. The computer itself will generate a respectable amount of heat that needs to be ventilated from the room. Air conditioning is always recommended, but it is not always essential. This is particularly true in a generally cool climate, and if you can suspend computing operations on really hot afternoons.

The reliability of electronic components degrades rapidly with increased temperature. Each 30° rise will cut the system's life in half. So, even though a computer will do everything asked of it in 95°, you are sending it to an early grave by expecting it to run excessively at that temperature.

Equally important is the cleanliness of the air. Smog usually won't hurt, but dust definitely can. It clogs the filters, which keep dust from settling on the electronic components, and blocks the flow of cooling air. Accumulated dust acts as an insulator, trapping excessive heat and inviting early collapse. Locate these filters early and service them regularly.

An especial case of dust-destructiveness is in the hard-disk drive, which, amazing as this sounds, uses air as a lubricant. Inside the drive, the disk whirls at speeds up to 120 miles per hour. The recording head that reads and writes the data on the disk moves back-and-forth over the surface like the tone arm on a phonograph. It doesn't touch the surface of the disk, however, but "flies" on a microscopic film of air 50 to 100 millionths of an inch thick. A speck of dust catching between these two fast-moving surfaces would scratch the record head and gouge the disk, ruining both.

Fifty-millionths of an inch is less than $\frac{1}{50}$ the diameter of a human hair, and $\frac{1}{5}$ the size of a particle of cigarette smoke. So you see how critical clean air is to a hard disk drive. These units, of course, have special and very elaborate air filtering arrangements. Find out how to replace these filters and do it regularly.

Dusty air problems can also be minimized if the computer is kept in an air conditioned, inside room—one with no doors or windows leading to the outside.

The issues explored here are generally unknown to the first-time purchaser of a computer. And most retailers won't mention them because they sound extremely complex, and pose a psychological barrier to a sale. But being forewarned still puts you ahead. Creating a happy home for your computer may present some headaches you hadn't planned. But the effort is necessary—and worth it. □

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Fly Your Computer

Flight Simulation Program





by Thomas Carbone

One aspect of computer simulation rarely encountered is that of flight simulation. Here is a program that provides a realistic simulation of a Boeing 747 aircraft from takeoff to landing. The objective is attained within the parameters of a minicomputer system using Basic.

Software, Hardware Requirements

The simulation was written using Extended Benton Harbor Basic #110.02.00. This is a variation of Basic distributed by Heath Company for it's H17 floppy disk system. The simulation is not restricted to use on this particular version of Basic. Modifications for other versions are described at the end of this article.

A Heath H19 video terminal is necessary in order to run the program. Other terminals cannot be used without extensive modification of the graphic routines. The program was written for use on a Heath H8 computer, but will work on most any system with the proper software or modifications. The only limit is on systems that do not have a real-time clock. This is a particular memory location or port in which the computer keeps track of the passage of time. You may refer to your operation manual to see if your system has this capability.

The program also requires some type of device in which data may be printed, aside from the H19 terminal. This may be a printer or an alternate video terminal.

How the Idea Was Developed

When I set out to create a flight simulation program, I had several parameters in mind. The most important aspect was versatility. In other words, the "aircraft" must be able to respond properly to any command the pilot initiates. Because of this, it became necessary to select an aircraft of which I have some knowledge. The Boeing 747 was the perfect choice for several reasons: I have flown in and been in the cockpit of a 747; any knowledge I needed could be easily obtained.

The flight simulator is composed of three programs

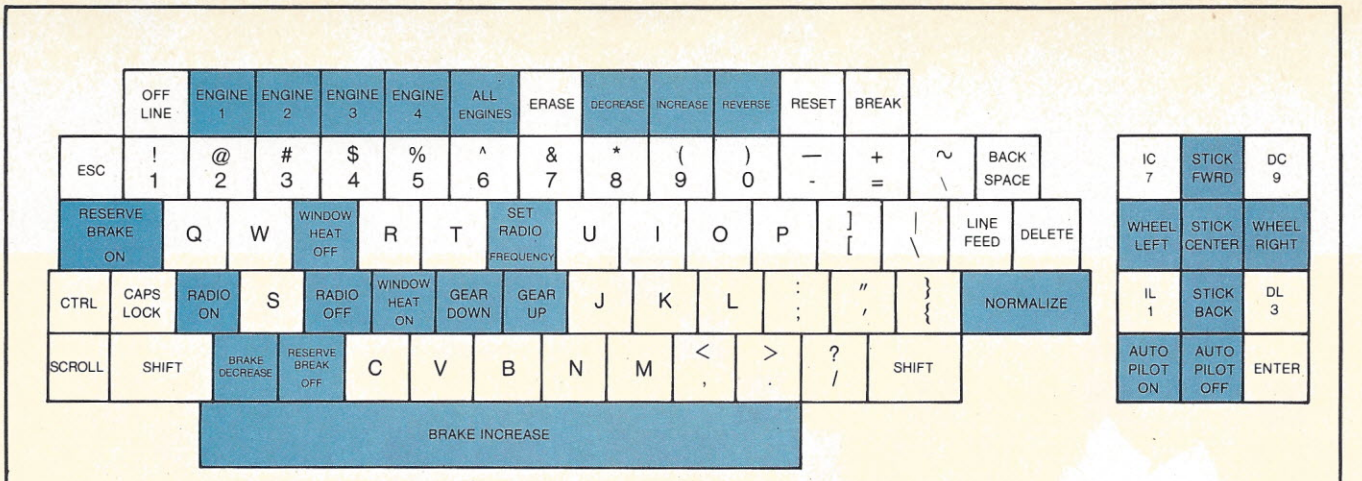


Figure 1. Keyboard Layout

linked together by 'chain' commands (commands used to transfer the computer to another program). The following three sections are technical descriptions of the four programs that comprise the simulation.

FLIGHT.BAS, INSTRUC.BAS

The purpose of 'flight.bas' is to inform the user of the title and objective of the simulation. It states departure and arrival time and destination. It also asks the user if instructions are needed. If the user informs the computer that he/she desires instructions, the computer transfers to 'instruct.bas.' If the user does not desire instructions, the computer transfers to 'display.bas.'

The objective of 'instruct.bas' is to instruct the user on how to operate the various controls and functions of the aircraft. It is beyond the scope of this program to teach the user how to fly. Rather, it is intended to teach someone who has a general knowledge of flying how to operate this particular aircraft. The instructions cover the use of the navigation map (figure 2), as well as how to enter your commands using the keyboard layout (figure 1). The instructions will also give the user several hints on how to make the flight successful. After the instructions are printed, the computer will shift control over to. . .

DISPLAY.BAS

The purpose of this program is to print a picture of the cockpit and instruments using the H19 graphics. The data statements within the program contain all the necessary data to print the cockpit. Each item of data contains three pieces of information. The first position informs the computer as to how many of a given character are to be printed. The second position contains the way in which the character is to be printed. Valid choices are: N = Normally, G = Print the graphic symbol represented by the character, R = Print the character in reverse video, and M = Print the graphic symbol in reverse video. The last position contains the character to be printed. For example, if a particular data item was "6Gx", the computer would print the graphic equivalent of "x" six times. If the data item were "N4", the computer would print a "4" normally. Note: since there is no number in the first position, the computer assumes that the character is to be printed once. If the computer encounters an "x" as a data item, it will generate a line feed. This process is continued until all the data has been processed. At that point, the screen will contain a reasonable image of a 747 cockpit. Control is then transferred to. . .

CONTROL.BAS

This is the heart of the flight simulation. This program contains all the formulas required to operate the aircraft. In addition, the program updates the instruments and determines if you have crashed. All of the variables used in this program are listed in table 1. Due to the complexity of the organization of the program, a list of functions by line number is necessary in order to explain the basic operation of the program.

Lines 10-20 initialize the variables and set the real-time clock at zero. Lines 40-130 update the instruments at the proper position on the screen. Lines 140-160 allow the user a set time interval to input the command. The operation C1 + PIN(232) places the Ascii value of the key depressed into variable C1. Lines 170-690 process the command located in C1. Line 700 places into T1 the elapsed time (in seconds) since the computer last processed this line. It also sets the clock back to zero. The syntax used to obtain T1 will be different on a non-Heath system. Lines 710-1310 calculate new values for the instruments and update the position of the aircraft. Lines 1320-1730 print the appropriate reason for the airplane crashing. Lines 1740-2310 print radio messages from the tower on the alternate terminal. Lines 2320-2360 print the runway in the window of the cockpit. Lines 2370-2560 determine if the next radio message should be sent or not.

Running the Program

Simply load 'flight.bas' into the computer's memory and then run it. The rest of the program is self-explanatory. The only other thing you will need is a keyboard layout (figure 1) and a navigation map (figure 2). The proper use of these items is described in the program instructions.

There are three sections of 'control.bas' that must be modified in order for the program to operate on a non-Heath system. The method of determining T1 must be changed. The printing of the radio message must be changed, and the method of obtaining the Ascii value of the command entered must be changed. Due to the vast number of different systems available, it is impossible to list the exact modifications required for each system. To determine the best way to go about modifying the three program functions to fit your

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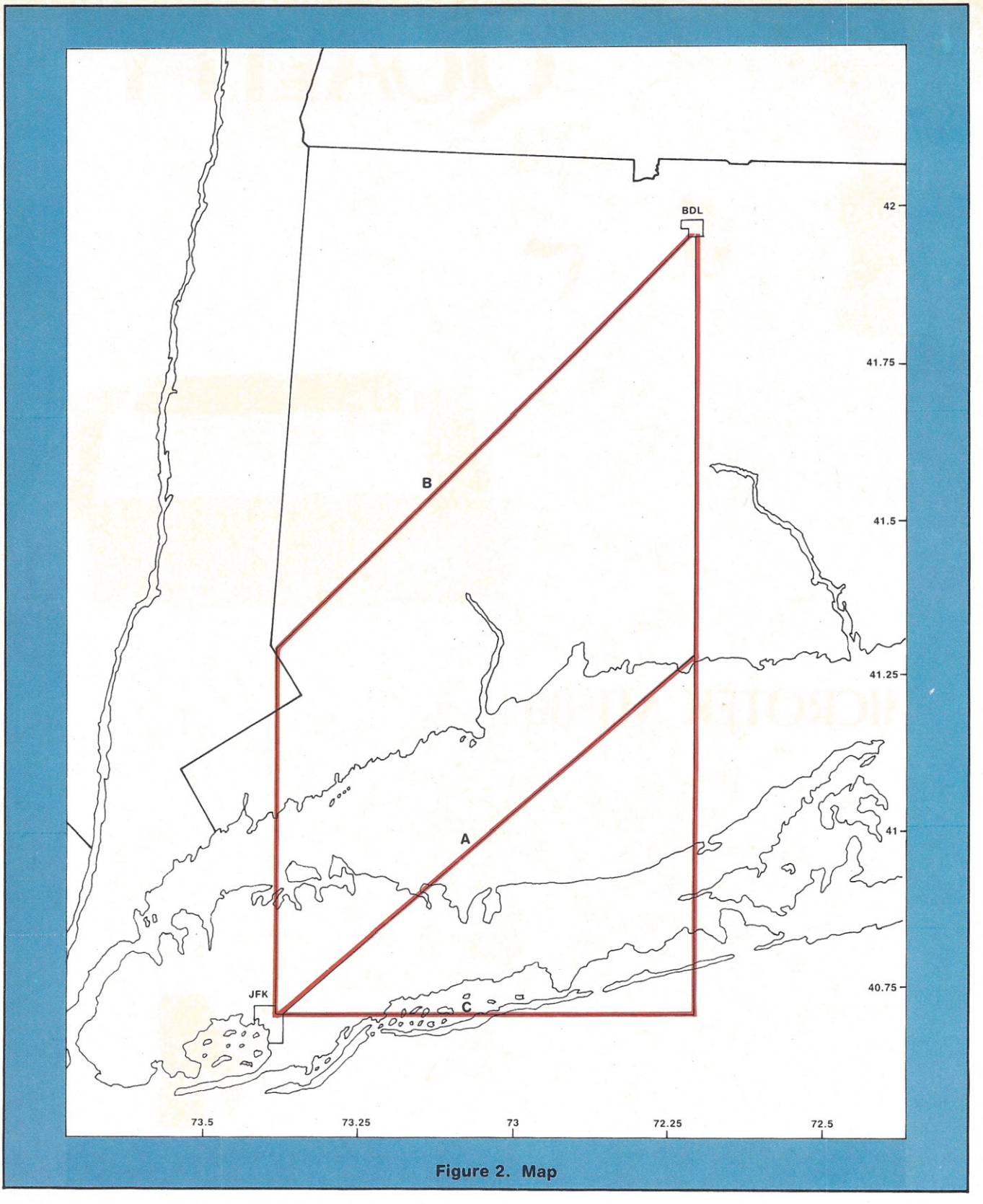


Figure 2. Map

system, read your operation manual.

One piece of information you may need to accomplish this is the reason for entering all the commas in 'display.bas.' This is used to fill the input buffer of the computer. When the input buffer of an H8 is full, it will generate a beep whenever a key is pressed, and the letter of the key pressed will not be displayed on the screen. This will not affect the PIN(232) statement and provide for a cockpit display without letters scattered all over it.

After you have become adept at flying the aircraft, you may wish to experiment with the program. One modification I have tried is to print a graph of time vs. altitude on a printer during the flight. The results of such a graph are both interesting and informative. Many such modifications are possible. You are only limited by your imagination (and your computer's memory). □

Program on Page 134

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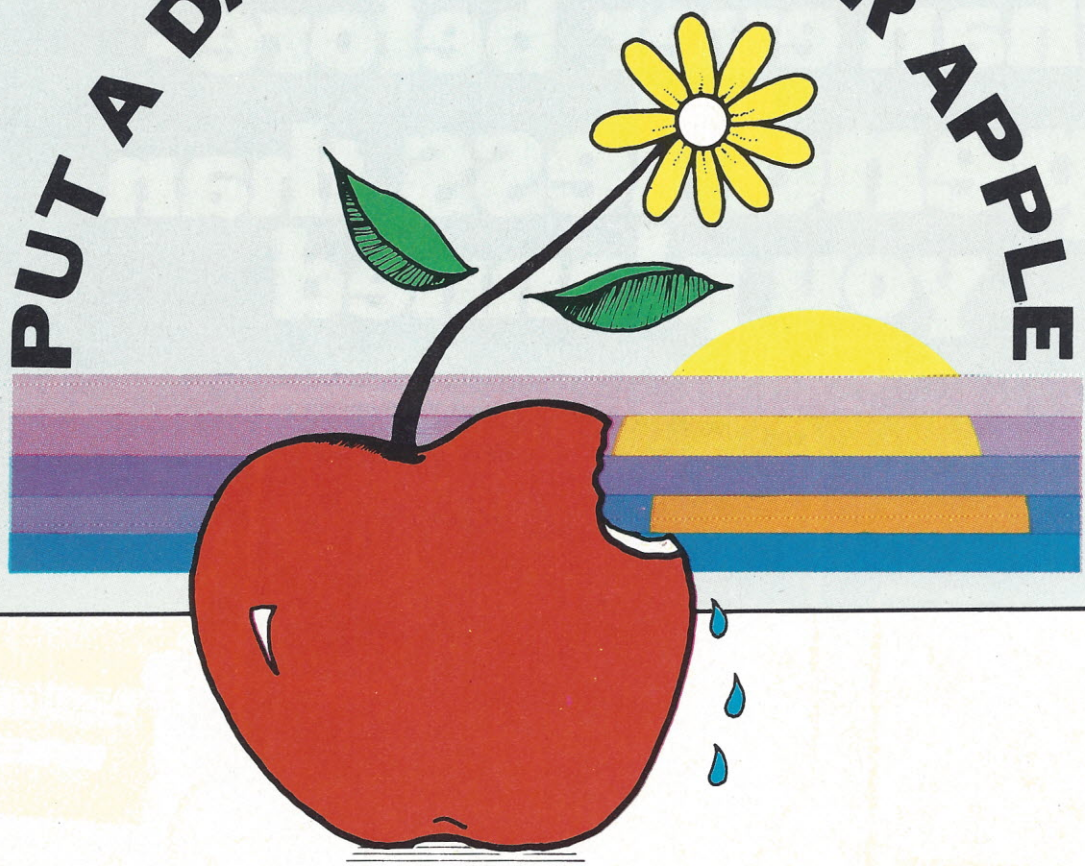


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CIRCLE INQUIRY NO. 34

PUT A DAISY ON YOUR APPLE



by John MacDougall

The Apple II personal computer is the size of a portable typewriter and has an excellent disk operating system. This makes the machine very adaptable for text processing applications where hard copy is a desired end result. A general purpose interface can be used for connecting an Apple computer to a Qume or Diablo daisywheel printer. Although these printers are superficially identical, there are enough differences in data bus structure to make it impossible to design a completely general purpose interface. It is strongly recommended that you read the printer operation and connection manuals before proceeding with the interface. With proper connection to the data bus and some slight differences in software, this interface has been used for a Diablo Hytype-I and a Qume Sprint Micro 3.

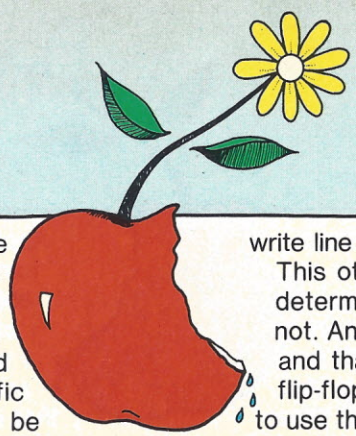
Interfacing to the Apple II

To build your own interface, obtain an Apple hobby/prototyping board. It comes with an application note which is one of the best descriptions of the Apple I/O interfaces around. Apart from the usual data and address bus signals, the designers included a complete decoding scheme on the main logic board. For very simple interfaces, additional peripheral address decoding may not be required. Thus the hardware necessary to construct this interface is simplified by making use of the decoding already provided by the Apple main board.

While reading the application note, you will see that the Apple I/O is memory mapped. Data to be outputted (or inputted) is sent to a memory location where the hardware takes over. In the Apple, each of the I/O slots is mapped into a different location in the C000 space with 256 bytes allocated uniquely for each slot. Obviously one doesn't need 256 bytes to send a piece of data. This allocation was intended to be used by simple firmware ROM chips which would be placed on the I/O card. Thus each peripheral device can carry its own driver routines.

In addition to the 256 bytes, there are an additional 2000 bytes in the C800 to CFFF space which can be used by any I/O device. The different I/O devices are kept off each other's toes by a hardware switch built into each interface which uses the C800 address space.

It is the responsibility of each interface intending to use the C800 space to be sure that all other interfaces are switched off before entering that space. This is done by addressing location CFFF. Operation of this scheme will be shown during description of the hard-



ware and software. The daisywheel interface carries its own firmware drives and must use the expansion space for the minimum possible configuration.

The usual problem with memory mapped I/O is that software is also tied to a specific memory area and the peripheral can only be used in the slot for which the software is written. If the driver routines are to be put in ROM, this becomes a severe restriction. Fortunately, with the Apple parallel printer card, it is possible to write relocatable 6502 code which can be used with special hardware to make a slot-independent peripheral. Thus the daisywheel software was made slot independent by being able to copy and adapt large portions of the first 256 bytes of the Apple II printer card software.

Description of the Interface

The circuit diagram of the interface is presented in figure 1 and the finished hobby card constructed with wire wrap is shown in figure 2. The schematic can be divided into two functional blocks: hardware to interface with the printer, and the driver firmware. The printer interface hardware will be described first.

Most of the I/O decoding is done by the Apple before the I/O slots. Thus pin 41 (called device select) already has been decoded to the level C080 + N0 where 'N' is the slot number. If we only wanted to control one device, this decoding would be sufficient. However, there are three separate ports to be controlled, so some additional decoding by the 74LS42 (Q1) is necessary. To simplify this, a complete map of the addressing for the interface is presented before the listing which follows the article.

The decoded control signals determine where the data bus signals will be sent or received from. Output from the interface to the printer is through the two 74LS374 octal registers. The first register (Q9) simply puts the low data byte on the lines to the printer while the second register (Q8) has a more complicated function: it must put the additional data on the printer data bus (2 to 4 bits depending on the printer), and output the strobes which determine what the data is to do in the printer.

Use of the data bus for strobing can cause problems because of the peculiar nature of the processor. The 6502 puts out valid data only during the last portion of the cycle. Thus, if this data is present at the strobe outputs for the full half-cycle, false strobing can occur. Fortunately the Apple has a signal which, when ANDed with the normal cycle, gives a delayed enable. This is the Q3 signal and is present on pin 37 of the peripheral slot. The Q3 is used only for the latch signal on the upper 74LS374 (Q8).

Input to the Apple from the interface is via the two quad multiplexors (Q10 and Q11). These are tri-state devices with a select input to determine what data is to be read and an output enable to put this data on the Apple bus. The select signal comes from the 74LS42 decoder and the enable signal comes from the read/write line in association with a bunch of other logic. This other logic, mainly the 74LS109 flip-flop, determines if the C800 space is to be read or not. Any read in the I/O slot will set the flip-flop and that and address to CCxxXX will reset the flip-flop. Therefore, if another peripheral wishes to use the C800 space, it simply addresses CFFF and turns off all C800 spaces (including its own). Remember that pin 1 (I/O select) decodes to the CNXX level while pin 20 (I/O strobe) is enabled for all C800 to CFFF addresses.

The two quad multiplexors Q10 and Q11 determine if the data bus data comes from the output of the 2708 Eprom or the select switches and printer 'ready' lines.

The 2708 Eprom contains the complete driver firmware on the card. How this is mapped is a little tricky. The first 256 bytes are, as stated earlier, essentially the same as the Apple printer firmware and contain the necessary code to determine which slot the peripheral is plugged into and the initialization instructions. Where this code is addressed depends on the slot, and the code is thus written in relocatable form.

In the Apple II parallel printer interface, the 256 bytes are the complete driver but there is some very clever combined code and hardware remapping. We were able to find the additional space necessary for some of the daisywheel initialization code by trimming. The real driver routines are contained in the C900 space but are still in a contiguous area of the Eprom.

To state it another way, the initial routines can be 256 bytes anywhere in the region C100 to C700 but the driver routines are located uniquely at C900. The problem of how to handle this and still use all of the 2708 is solved by hardware relocation of the address bus for the 2708. When the 2708 is addressed in the range C100 to C700, the AND gates in the A9 and A8 address lines are disabled and only the addresses below 256 bytes are used. When the address range is outside the slot range and inside the C800 space, the top two address bits are enabled and the address range is effectively remapped into the higher space.

Of course, the first 256 bytes were already used in the lower slot space, so when it is remapped to the higher address area, data must start at C900. All this activity is transparent to the Apple. Happily, it knows that the correct code will be present above C800 after addressing an I/O slot.

The other type of inputs to the 74LS257's is split between the simple mode select switches and the printer handshake 'ready' lines. The mode select switches allow setting double line spacing and either 10 or 12 characters per inch character spacing. In addition, they can be used to set the printer impact pressure in machines with this option. Every time the driver routine is accessed, these switches are checked and the corresponding pressure or spacing is applied.

There are four 'ready' lines from the printer: for the total printer, the platen, the carriage and the print

wheel. Note that all signals to and from the printer are negative logic (a '1' is a 'low' voltage).

There is only one other bit of hardware left—the ribbon life timer Q5. Ribbon lift on these daisywheel printers is a separate line. When the signal is low, the ribbon is lifted. When the signal is high, the ribbon is allowed to drop, revealing the printing. Obviously you don't want the ribbon constantly popping up and down, nor do you want it to obscure the printing. A reasonable compromise is to use a timer that holds the ribbon up for about a second then lets it drop if no new characters come along. A 9601 retriggerable one-shot is used for this. Its range is extended by means of the 2N2222A emitter follower transistor. If you don't like the time constant, you can change the capacitor value.

Basic Software

The software accompanying this article is only to get you up and running. It does not have the ability to buffer the input and then type in reverse; nor does it substitute carriage tabs for a succession of spaces—two desirable features that speed up printing.

Refer to the software listing. If you have access to the listing for the Apple parallel printer card, it would be helpful to examine that listing for comparison. The first 256 bytes are derived exactly (including the same comments) from the printer card software. However, because of the peculiar tie in between the software and hardware in the printer card, it is necessary to modify the software. This is also necessary to provide the additional space for the printer initialization and for the jump to the driver routines.

The way that the Apple handles the printer routine is that on first entry it accesses the code at the slot address. The first thing the code does is to clear the carry flag. The presence of the cleared carry flag is used throughout the start of the program to give a succession of relative jumps as the software is initialized. The first of these jumps is merely a fake to hide the second entry point at CN00 + 2 (where 'N' is the slot number). This second entry point is used by all succeeding accesses of the routine as determined by the Apple monitor. Note that all of these relative jumps are simply a clever way of writing relocatable code so that the firmware may work in any of the Apple I/O slots.

I won't try to explain the parallel printer card software in detail. It is sufficient to understand that its details have been kept intact while adapting them to the daisywheel interface.

Two points should be noted, however. One is that there is a jump to the C800 space during initialization so that special initialization of the driver registers can be made. The second is that unlike the printer card firmware, the daisywheel firmware requires a very extensive driver, so the outputting of a character involves a jump to a C800 subroutine rather than a simple STA.

In the driver routine, all of the registers are saved and the printer strobes are initialized. The incoming byte is then checked to see if it is an Ascii character. If so, it is printed without delay. This is designed to work on the most likely possibility and thus make the software as fast as possible. If the byte is not an Ascii character, it is checked for all the possible printer control characters such as carriage return, space, etc. If no useful character is found, nothing is done and the routine returns gracefully to the Apple without doing anything.

Note that the Qume data bus uses the Ascii characters in positions D1 to D7 rather than D0 to D6. The software listing is configured for the Diablo. To modify for the Qume, insert an ASL-A (code '0A') in place of the NOP at line 254.

Daisywheel printers handle carriage movement incrementally and, therefore, need to calculate and store the carriage location at all times. This information, as well as other useful data, is stored in the hobby card reserved spaces. These are in the low resolution window area of memory (but outside the display regions).

It is possible that some programs will scroll the entire low resolution area rather than only the displayed parts. Naturally this will totally destroy such things as your carriage position and cause a printer to crash. Any software supplied by Apple should not do this, but occasionally other programmers are not aware of this reserved space. If you can't get the software fixed then you will have to change the driver routines to use memory locations which do not get destroyed. □

Figure 1 and Program Listing Start on Page 128

An article describing how to interface to a daisywheel printer was published in IA in Oct, 78. It contains all flow charts and a detailed description of the operation of the program. The driver routines for the Apple interface were converted almost routine for routine over to the 6502 code. The reader might like to compare the two driver programs side-by-side to see the differences between Z-80 and 6502 codes.

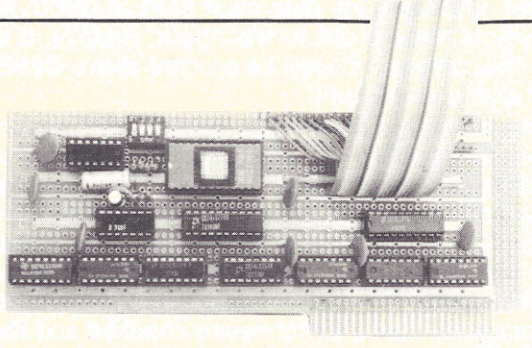
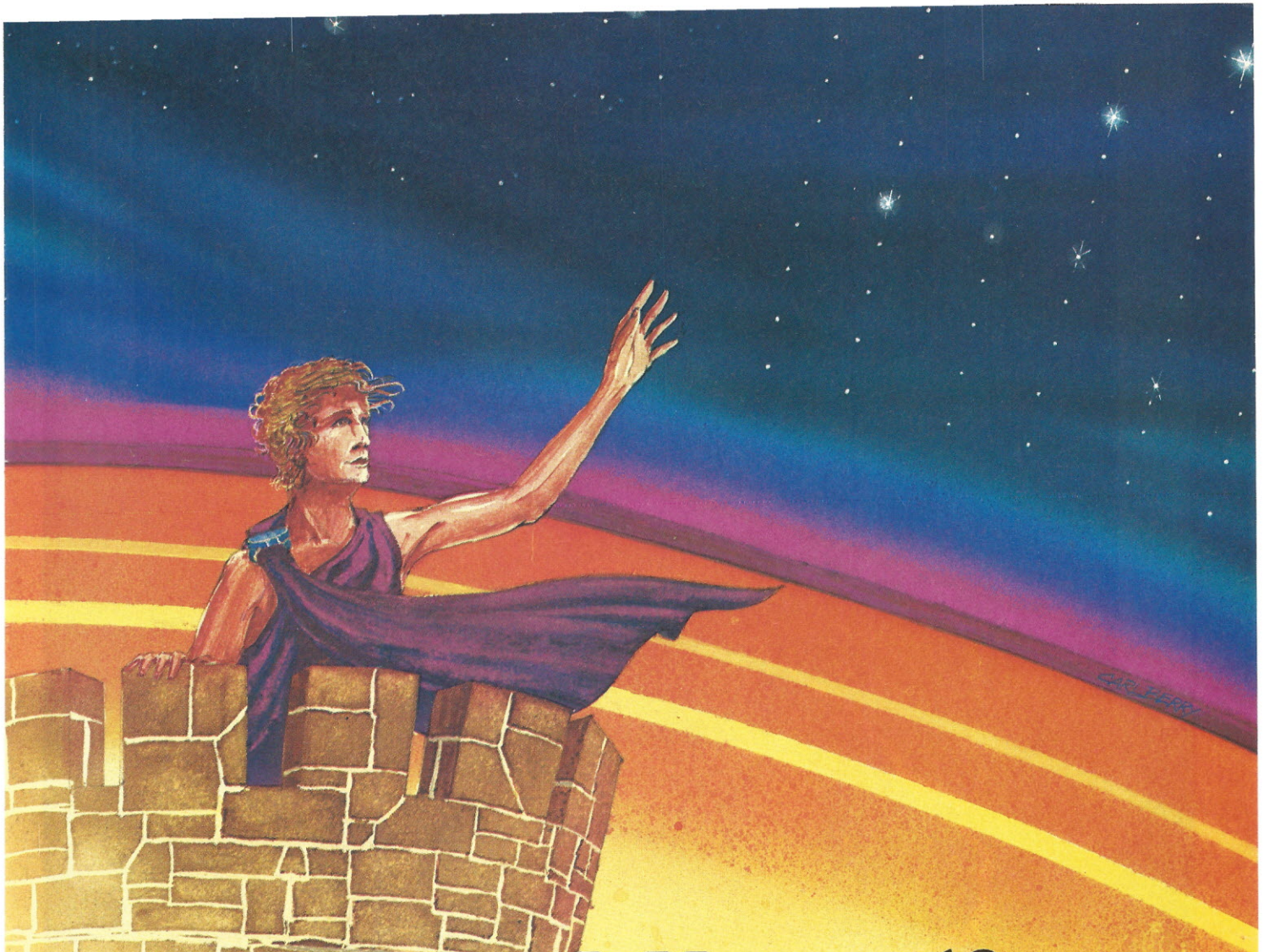


Figure 2. Daisywheel printer interface constructed on an Apple II prototyping board.



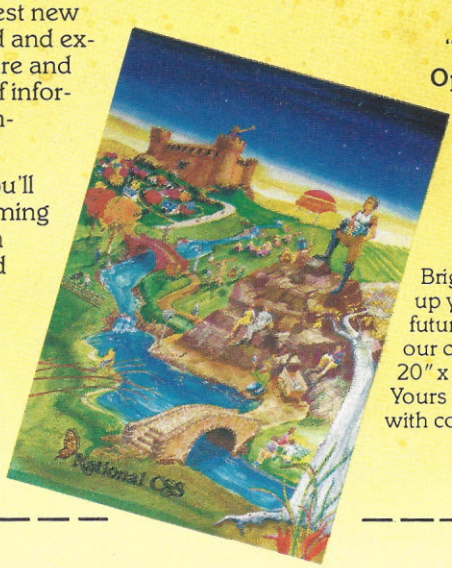
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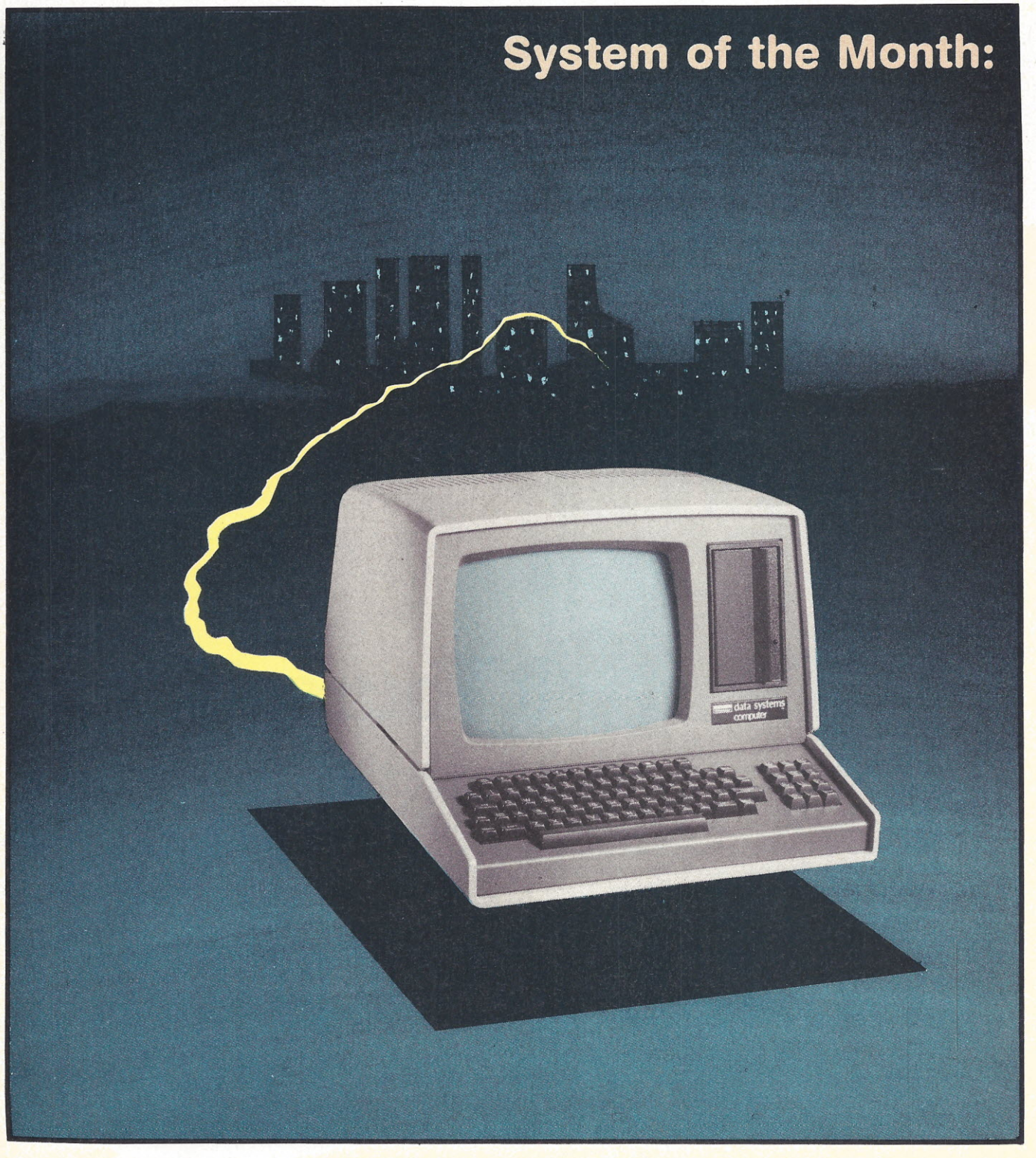
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System of the Month:



Heath WH89/Zenith Z89

by Tom Fox

For many years, Heathkit products have graced the living rooms, workshops and radio shacks of those who felt comfortable with a soldering iron in their hands. The glow of accomplishment gained by building a complex electronic device from a box of loose parts was a goal in itself. The usefulness of the completed device was a secondary consideration.

When Heath entered the computer market, a subtle but significant change occurred: the computers became valuable possessions—even to those who had no interest in the education to be gained in the construction process. The H89 all-in-one computer kit, in particular, soon became available as the WH89 or "wired" H89. It's as complete as most any other microcomputer to be found in the retail stores.

When Zenith purchased Heath a short time ago, it scoured the Heath catalog for useful additions to its product line. They zeroed in immediately on the H89, designed a new nameplate and voila!— the Z89 microcomputer. The two machines are identical. With Zenith's experience in merchandising and massive base of retail distribution, we are likely to see a lot of Heaths hiding behind Z-badges.

Pros and Cons of Compact Structure

The WH89 incorporates most of its essential hardware items within a very compact 13 x 17 x 20-inch plastic enclosure that is smaller than many CRT terminals by themselves. The computer, floppy diskette drive and interface cards have been neatly tucked into the unused space of the WH89's sister product, the H19 CRT terminal.

The squeeze is a tight one, and maintenance access to the various boards suffers as a result. Adequate cooling is often a problem with such densely-packed circuitry, but a muffin-type ventilation fan keeps it in check. The fan blows warm air directly upwards through cooling slots on the top of the unit, so you have to be careful not to place heat-sensitive items (such as floppy diskettes) over them.

One other orifice bears watching: The maw of the front-mounted floppy diskette drive is large enough to swallow a child's hand up to the wrist. While we are fairly sure there are no hazardous voltages inside, it is easy to touch a rotating part or the sharp cut-off leads of the circuit card components.

Primary Circuitry Source

A total of five circuit boards contain the bulk of the WH89's electronic circuitry. The two main boards (terminal logic board and CPU logic board) are identical in size at 9 x 11 inches. They each contain a Z80 microprocessor integrated circuit chip running at a speed of 2 MHz. The computing load is thus shared by the two processors—one to run your programs, and the other to manage the details of terminal display and keyboard manipulation. The CPU logic board also contains 48K bytes of RAM. Because a certain portion of the memory address space is reserved by the system, it is not possible to expand the RAM beyond this size.

The CPU logic board will accept up to three smaller boards: floppy disk interface, serial interface and cassette interface. Each is 4 x 8 inches in size. All but the cassette interface are standard with the WH89.

The two remaining cards within the unit are the video circuit board and power supply circuit board. Except for the two interface boards, the cards interconnect via a nest of ten or more cables and plug-in connectors. The odd shape of the space available within the enclosure seems to preclude the use of the desirable mother/daughter board concept featured in other Heath products.

The Wangco disk drive will accept a single 5¼ inch single-sided minifloppy diskette. Each hard-sectored diskette will store up to 102 Kbytes of data in 400 256-byte sectors. Recognizing that the individual performance of the drive mechanism can vary from unit to unit, the Heath software package includes a routine to see just how fast the mechanism can move the recording head from one track to another.

There is then a way to instruct the disk operating system to step at that rate. The unit we tested worked well at a remarkable 8-millisecond step rate, even though Heath will only guarantee the drives to work at 30 milliseconds and slower. We cranked up the speed to 8 milliseconds and enjoyed a dramatic and welcome performance improvement with no noticeable loss in reliability.

To add more disk storage capability, you can purchase the WH87 dual minifloppy diskette drive to bring

the total online capacity up to 306 Kbytes. If only one extra drive is needed (for a total of two) a kit version of the add-on drive must be purchased and assembled.

Hallmark Feature: The Terminal Itself

Heath's grand accomplishment in the WH89 is the CRT terminal itself. The unit is robust and handsome, and includes many features usually available only on premium-priced "smart" terminals. The 84-key keyboard is laid out like a typewriter's, which is slightly different than the teletype-style arrangement more common in the computer industry. It incorporates eight special function keys.

The terminal will operate at 12 different baud rates, although only the highest—9600 baud—is used in the WH89 application. The 12-inch display screen holds up to 25 lines of 80 characters each for a total of 2000 crisp upper- and lower-case characters. The terminal includes character- and line-insertion and deletion modes and a graphics capability. None of the Heath-supplied software we have seen capitalizes on these niceties.

A small speaker is tucked away on an inner recess of the computer. Its function is to provide the familiar "beep" tone, and (optionally) to sound a tiny "click" each time a key is depressed. In the unit we tested, the sounds were barely audible.

Heath offers five separate hard copy printers. The least expensive is a matrix printer of their own design which features a novel variable printing speed. The other devices are Heath-labeled versions of Texas Instruments' TI810, Digital Equipment Corp.'s Decwriter II and Xerox Diablo 1640. All except the latter utilize dot matrix mechanisms. The Diablo unit spins a patented daisywheel to place fully-formed characters on the page. This would be the device to choose for letter-quality word processing applications.

Serious Quality Software

It comes as somewhat of a surprise to discover the wide array of serious-quality software that can be had with the WH89. Heath software tends to carve a course close to the hardware realities of the machine itself, requiring a more complete knowledge of the workings of the computer.

The Monitor is supplied as 2 Kbytes of firmware in ROM, which means that it need not be loaded from diskette or tape, but is active instantly when the power is turned on. Its major function is to boot (start up) the system under the more elaborate HDOS (Heath's disk operating system), but it retains a spare set of six commands directly available from the keyboard.

These commands allow you to display and change data in RAM and load and run programs from cassette tape. The latter capability requires an extra-cost cassette drive and interface module. Additional programs are buried in the Monitor to test system memory and diskette drive speed.

HDOS keeps track of all data read from, and written to, the minifloppy diskette drive(s). It also includes a variety of commands—many of them separate programs:



- Set system date
- List file directories
- Copy, rename and erase files
- Type files on the terminal or printer
- Exercise and test the diskette drive
- Set peripheral characteristics (baud rate, etc.)
- Initialize and verify floppy diskettes

HDOS requires a minimum of 2.4 Kbytes in RAM, and up to 9 Kbytes when certain commands are active. The file naming conventions incorporate a generous wild-carding ability that allows you to globally refer to a class of files with similar names. Entering 'delete file0?.dat,' for example, will erase all files with the name 'file01.dat, file02.dat.'

File-loading diskettes

HDOS includes a program called Onecopy which makes the best of the inconvenience caused by having but a single drive when it comes to copying files from one diskette to another. Onecopy will load files from one diskette into RAM, and then instruct you to insert a second diskette so the RAM contents can be dumped onto it. Depending upon the amount of data to be transferred, the program may instruct you to swap the diskettes two or three times before the copying process is complete.

The software package includes Extended Benton Harbor Basic, a modest but useful example of this almost-universal language. This Basic requires some 12 Kbytes of space in RAM in addition to HDOS. Heath's Basic is a pure interpreter, and has a tool kit of 42 commands and 31 functions, including a few which are only usable on the WH89's predecessor, the hobbyist-oriented H8 microcomputer. A generous dollop of string handling commands is available, as are most of the usual transcendental functions (logarithmic, trigonometric, etc.). Benton Harbor Basic has one shortcoming for business applications, however: it contains no mechanism for reading or writing data files to the diskette drive.

For a modest extra cost, we strongly recommend purchase of the H89 Microsoft Basic. Even though Microsoft's version requires more memory space, it is superior in almost every respect to Benton Harbor Basic. It features 116 commands and functions, including editing features which allow you to alter a program statement without retyping the entire line. Both sequential (Ascii) and random (binary) data files are supported. Microsoft Basic ran the prime number cruncher (IA Jun 80) in 2027 seconds, more than twice as fast as Benton Harbor Basic's 4211-second performance.

Edit program for text

The WH89 software package includes three major modules intended for use by programmers in 8080 assembly language. The first is Edit, which allows the entry and alteration of source programs to be used for all manner of text files (letters, proposals). Be warned, however, that the Edit concepts and commands come from an earlier generation of text editors. It is line oriented, rather than screen oriented, and requires the memorization of a puzzling set of special control sequences in order to get the most utility.

Once a source program is keyed in via Edit, a program called ASM is activated to convert it into 8080

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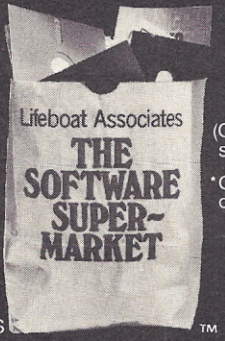
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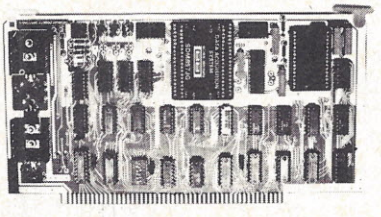
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machine code, which will run on the WH89's Z80 microprocessor chip. ASM is a conditional assembler, and features pseudo opcodes for programmer convenience. We would, however, miss the ability to define macros, or "super instructions," a feature of certain other assemblers.

Debugging method available

Recognizing that programs seldom work without a little massaging, Heath includes Dbug, a useful debugging tool for analyzing the operation of assembly language programs. With Dbug, you can single-step a program, inspect and alter the contents of memory locations and data registers, and insert breakpoints in the program flow. Dbug also allows the loading and dumping of assembled programs to the floppy diskette.

By way of the Zenith connection comes a word processing program called the Electronic Typing System. It is a version of Autoscribe out of the Phoenix Group that has been specially adapted by the authors for the WH89.

Documentation

For over 20 years, nearly everyone who picks up a Heath technical manual has had the thought, "now that's how documentation should be done!" Heath has set the standard for attractive, informative and accurate user manuals.

Since the WH89 is one of Heath's more complex offerings, it is not surprising to see that a hefty portion of the overall system weight is made up of paper. The Operation/Service manual is a 260-page education on microcomputer systems hardware as exemplified in the WH89. This book covers everything from instructions in integrated circuit insertion to timing diagrams for the Z80 chip, and includes operation, troubleshooting and circuit descriptions in depth.

The Software Reference Manual is another 440 pages of discussion on the five major systems software packages (HDOS, Dbug, Edit, ASM and Benton Harbor Basic), plus the ROM-delivered Monitor. If you think you have to wade through a stack of data before even turning on the machine, take heart: the book contains a "First Time Through" introductory chapter which allows anxious types to safely bring up the unit in the minimum possible time. The Microsoft Basic option is served up with its own 110-page book which only describes the Microsoft-unique features of the language, and does not pretend to be a Basic learning guide.

Finally, those who opt to build their own WH89 have the opportunity to mark the boxes in 100 pages of Assembly Manual, which—except for the schematic diagrams—is only used once.

Unit and Kit Costs

A completely assembled WH89 with 48 Kbytes of RAM and a single minifloppy diskette drive lists for $2895. The kit version of the same unit is $900 less. Printers are available in the range of $795 to $2995. The add-on dual floppy diskette drive lists for $1195.

On the software side, the HDOS systems software package is $150. The enhanced capabilities of Microsoft Basic is also available for $150. Their newest offering is the $395 Zenith word processor, which also requires a printer. The cost of each program includes a year's free updating service. □

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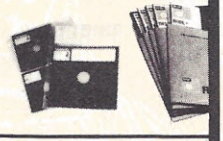
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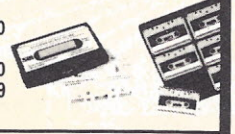
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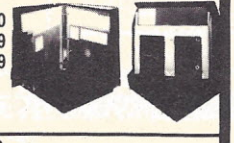
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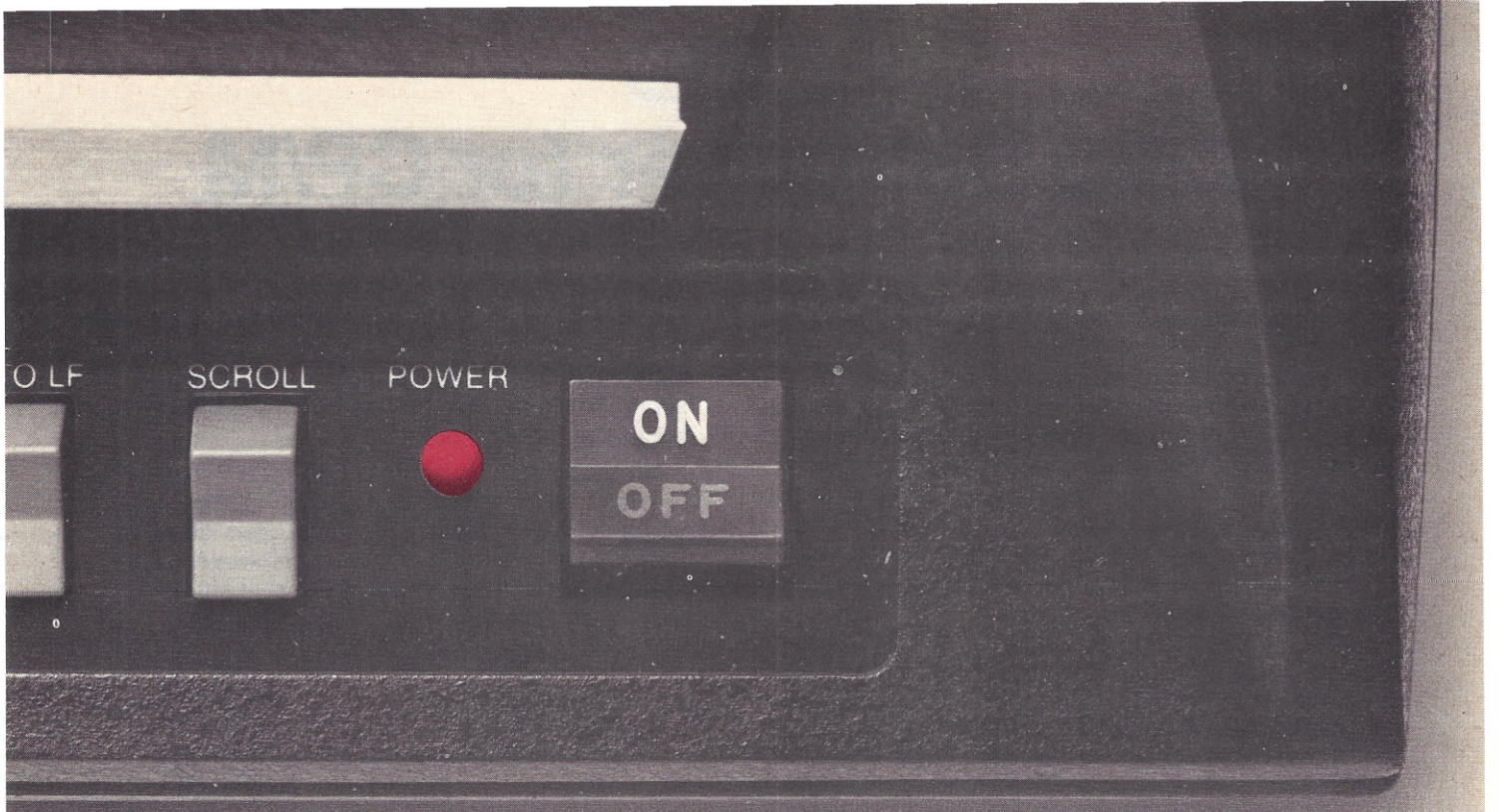
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CIRCLE INQUIRY NO. 12

ZSID
Z-80 Debugger for CP/M

by Alan R. Miller

One of the standard programs provided with CP/M is DDT (dynamic debugging tool), an independent program used to test and debug other programs.

SID (symbolic instruction debugger) is a more advanced debugger than DDT. The regular version operates on both the 8080 and Z-80, but the symbolic features refer only to the standard Intel 8080 assembly-language mnemonics. ZSID is a Z-80 version of SID utilizing the official Zilog mnemonics. Since ZSID is written with Z-80 instructions, it will not operate on an 8080 machine.

CP/M programs normally execute in the transient program areas (TPA) starting at 100 hex. When SID is executed, it is initially loaded into the TPA, then automatically relocates itself to the top of the usable CP/M memory. This leaves the beginning of the TPA available for the testing of other programs. After SID is in place, it can be directed to load a separate program into the TPA. Alternately, a separate program can be loaded along with SID by including the program name in the command line. For example, the statement:

```
B>A:SID PAYROLL.COM
```

will first load SID, then SID will load the program 'payroll.com.' If the program is a hex file, then SID will decode it, placing it where it belongs.

Monitor Features

SID contains most of the usual monitor features. For example, a command of: 'D100, 17f' will display memory locations from 100 to 17f hex. Each location will be given in hex and also in Ascii if the characters are printable. DDT and the 8080 version of SID give the Ascii values at the end of the same line as the hex code. ZSID, however, places the Ascii characters on the next line under the corresponding hex code. This format is more convenient for narrow video screens.

A block of memory can be moved with the M command. S allows the user to change (set) memory locations. Hexadecimal addition and subtraction can be performed with the H command. The X command allows the user to examine and alter the CPU registers. These include the general-purpose registers, the alternate register set, the flag register, the program counter, the stack pointer, and the X and Y index registers. There is no search command available in the debugger, nor is there a command for inputting or outputting through an I/O port.

The L command produces a symbolic disassembly of the machine code using the official Zilog mnemonics. The A command allows assembly-language mnemonics to be coded directly. Z-80 assemblers are not consistent in their mnemonic sets. Consider the subtract instructions:

```
SBC   A,C
SBB   A,C
```

The first is the official Zilog mnemonic for an 8-bit subtraction with borrow. The second is also allowed by some assemblers, since it resembles the 8080 mnemonic. But ZSID will not accept the second version during the A operation.

Another Z-80 peculiarity occurs with the set of addition and subtraction mnemonics. Zilog uses two operands for addition and subtraction operations in both 16-bit and 8-bit versions. However, only one operand is used for the 8-bit 'sub' instruction since there is no corresponding 16-bit operation.

16-bit		8-bit	
ADC	HL,DE	ADC	A,E
ADD	HL,DE	ADD	A,E
SBB	HL,DE	SBB	A,E
		SUB	E

Since the accumulator is always the destination register for the 8-bit operations, the argument is not really needed. For this reason, some assemblers do not require the destination operand for any of the 8-bit add and subtract operations. ZSID, however, requires two operands for all 'adc', 'add,'and 'sbb' instructions. Another common variation allows two operands for 'sub' command:

```
SUB   A,E
```

making the instruction look more like the other add and subtract operations. This form has been incorporated into ZSID although it is not a Zilog mnemonic.

Executing a Program with SID

Several commands allow the user to execute a program under control of SID. Suppose that a program works properly until it reaches the address of 244. The program can be loaded with SID, then the command 'G100,244' can be given. This will start the program at address 100 hex, the first argument, and set a breakpoint at address 244, the second argument. If the program gets to address 244, control will automatically return to SID. This happens because SID replaces the original byte at address 244 with an RST 38H instruction. When control returns to SID, the original byte is restored. Then the user can inspect the CPU registers, change them if desired, and continue execution of the program with another G command.

The P command is similar to the G command; it allows an instruction to be passed a given number of times before the program returns control to SID. This command is convenient for debugging loops. The T command can be used to single-step through a program. This command can also be used to trace back through the previous steps.

Arguments to SID Commands

Several different types of arguments can be given with SID commands. The default radix is hexadecimal,

but this can be changed with a prefix. A # sign precedes a decimal number and an apostrophe is used before an Ascii character. Hex arguments to ZSID are a little different from those of the 8080 version of SID. The latter accepts any valid hex number. With ZSID, however, the first digit of a hex number must be one of the decimal digits 0-9, i.e., a leading zero must be used if the first digit is A-F. This restriction is necessary because the Z-80 mnemonics have a different structure from the 8080 mnemonics.

Consider the 8080 instructions:

```
MOV   A,C
MVI   A,C
```

The first is a register-to-register move; the second instruction loads the value of C hex into the accumulator. The 8080 version of SID can distinguish between the two instructions since the mnemonics are different. The Z-80 equivalent, however, uses the same mnemonic for both instructions:

```
LD    A,C
LD    A,0C
```

and so a leading zero must be used to distinguish the hex value of C from the register name C. Arguments can be expressed relative to the previous address. For example, a command of D100, + 5 will display memory from address 100 to 105.

Symbolic References

The Digital Research assemblers MAC and ASM and the Microsoft assembler Macro-80 with its linking loader can produce a separate symbol table. SID can be directed to load this symbol table along with the program being tested. Symbolic references from the symbol table can then be used as arguments to SID. The symbols can be used in three ways.

If preceded by a decimal point, the symbol is used as a pointer. Suppose the symbol table contains the label 'outhz' corresponding to the program address of 163. Then the command 'l.outhx, + #20' will disassemble 21 (decimal) locations starting at the address of 'outhx.' Furthermore, the symbol table entries will be given in the listing whenever possible, both as addresses and as operands to instructions. A typical disassembly, if the symbol table is loaded, might look like this:

```
OUTHX:
  163  CALL      0167     .HEX
  166  LD        A,B
HEX:
  167  AND       OF
```

The value stored at the address corresponding to the symbol can also be obtained. If the symbol is preceded by an at-sign, the 16-bit value at the referenced location is utilized. On the other hand, if the symbol is preceded by an equal sign, the byte value at that location is chosen. Suppose the symbol 'iobyte' has been defined as location 3. Then the current value stored at that address can be obtained with the command:

```
H = IOBYTE
```

Programs with Arguments

Some CP/M programs require one or two arguments on the command line. The statement:

```
A>LIST B:SORT.PAS
```

will direct CP/M to load and execute the file 'list.com' from drive B. Additionally, the filename 'b:sort.pad' is placed in memory at the file-control block starting at 5C hex. Finally, CP/M starts the program 'list' by branching to the address 100 hex. Programs such as 'list' that require arguments on the command line can be debugged with SID. In this case, the first command would be:

```
A>SID LIST.COM LIST.SYM
```

This line loads SID, list and list's symbol table. The next step is to set up the file-control block. The command:

```
#IB:SORT.PAS
```

will write the requested filename into the file-control block. Now the program 'list' can be started up under control of SID. The G, P or T command is given with the appropriate breakpoint so control will return to SID at some point.

When a program is run under control of SID, the stack is initially placed at 100 hex. The program being tested should change the stack pointer to something else if a disk read is to be performed. This step is necessary since CP/M uses the region 80 to FF hex as a buffer for the disk operations.

Undocumented Z-80 Instructions

Purchasers of ZSID are provided with the regular SID user's manual and a handy supplement that summarizes the official Zilog instruction set. A more complete summary of the instructions is available from Zilog. But there are many Z-80 instructions that have not been documented by Zilog. Most of these are 8-bit operations involving one of the two 16-bit index registers. The official instructions all involve 16-bit operations for the index registers.

Suppose that we want to move register C into the low-order byte of the IX register. One way to do this using the official instructions is:

```
PUSH    BC
POP     IX
```

But this method will also move register B into the high-order byte of IX. A more direct way to perform the move is to use one of the undocumented instructions. The assembly language mnemonics which can generate the necessary code are:

```
DEFB    0DDH
LD      L,C
```

The byte DD precedes all of the undocumented 8-bit IX operations and FD precedes all undocumented 8-bit IY operations. Then the appearance of L or H in the remaining part of the instruction is interpreted by the Z-80 CPU as the low or high order byte of the corresponding index register.

The move from register C to IX can be performed with ZSID. First write the value DD into memory with the set command:

```
#S4000
4000  00  DD
4001  00 .
```

Then use the A command to enter the move operation:

```
#A4001
4001   LD   L,C
4002
```



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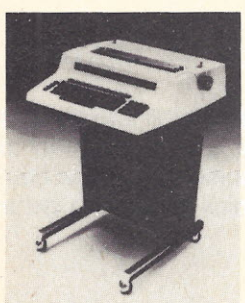
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CIRCLE INQUIRY NO. 74

Load register C with the value of 12 using the X command:

```
#XB
BC  0000  12
```

Then display all the CPU registers with the X command. Execute this short program with the G command, being sure to set a breakpoint so control will return to SID:

```
#G4000, 4002
```

Finally, examine the CPU registers with the X command. The low 8-bits of the IX register will now contain the value 12.

All of the regular Z-80 8-bit instructions involving the H and L registers can be used in this way. If the regular instruction is preceded by a DD then the operation is performed on the corresponding half of the IX register. If the byte is FD then the IY register is used. The operations include register-to-register moves:

```
LD   H,r
LD   r,H
LD   L,r
LD   r,L
```

where r is one of the general purpose registers A, B, C, D, E. Registers H and L now refer to the index register. Thus the instruction:

```
DEFB   0DDH
LD     H,L
```

will move the low half of IX into the upper half of IX. Immediate instructions can also be performed. The low half of IY can be loaded with the value of 7 by using the instructions:

```
DEFB   0FDH
LD     L,7
```

The 8-bit arithmetic and logical operations, including the shift and rotate instructions can also be used in this way.

These undocumented Z-80 instructions have been incorporated into Allen Ashley's PDS software. But there are several potential problems with using undocumented codes. The immediate problem is that ZSID will not properly decode the instructions. Also, these instructions might not be available on future versions of the Z-80, especially if the chip is obtained from a second-source supplier. Nevertheless, these 8-bit instructions give the programmer some extra registers that may occasionally be needed.

Despool Program

A separate Despool program is available from Digital Research. This program keeps the printer busy while the user does other things on the video screen. Since the CPU operates so much faster than the peripherals, it is possible for all peripherals to operate at once. Large, main-frame computers and minicomputers typically work this way. With microcomputers only one peripheral usually operates at a time.

The KLH spooler (IA Apr 79) spools the operation of the printer in a variety of ways. It can be operated from Basic, from an editor, or from the systems level. It can only operate with 8-inch soft-sector disks; Despool can operate with any CP/M system and any type of disk. Unfortunately, files can only be spooled from the systems level, and the printer stops momentarily every time the console keyboard is in use. Nevertheless, Digital Research's Despool is better than nothing. □

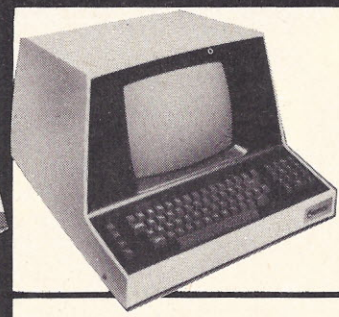
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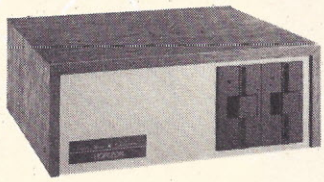
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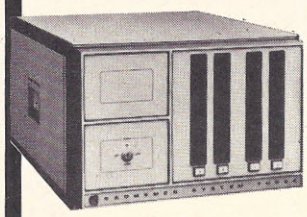
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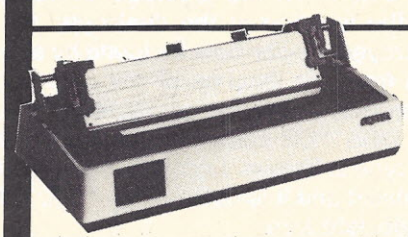
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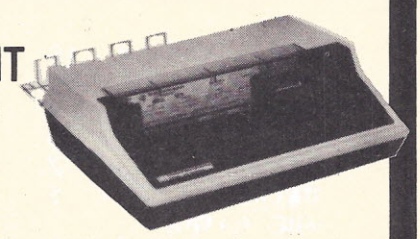
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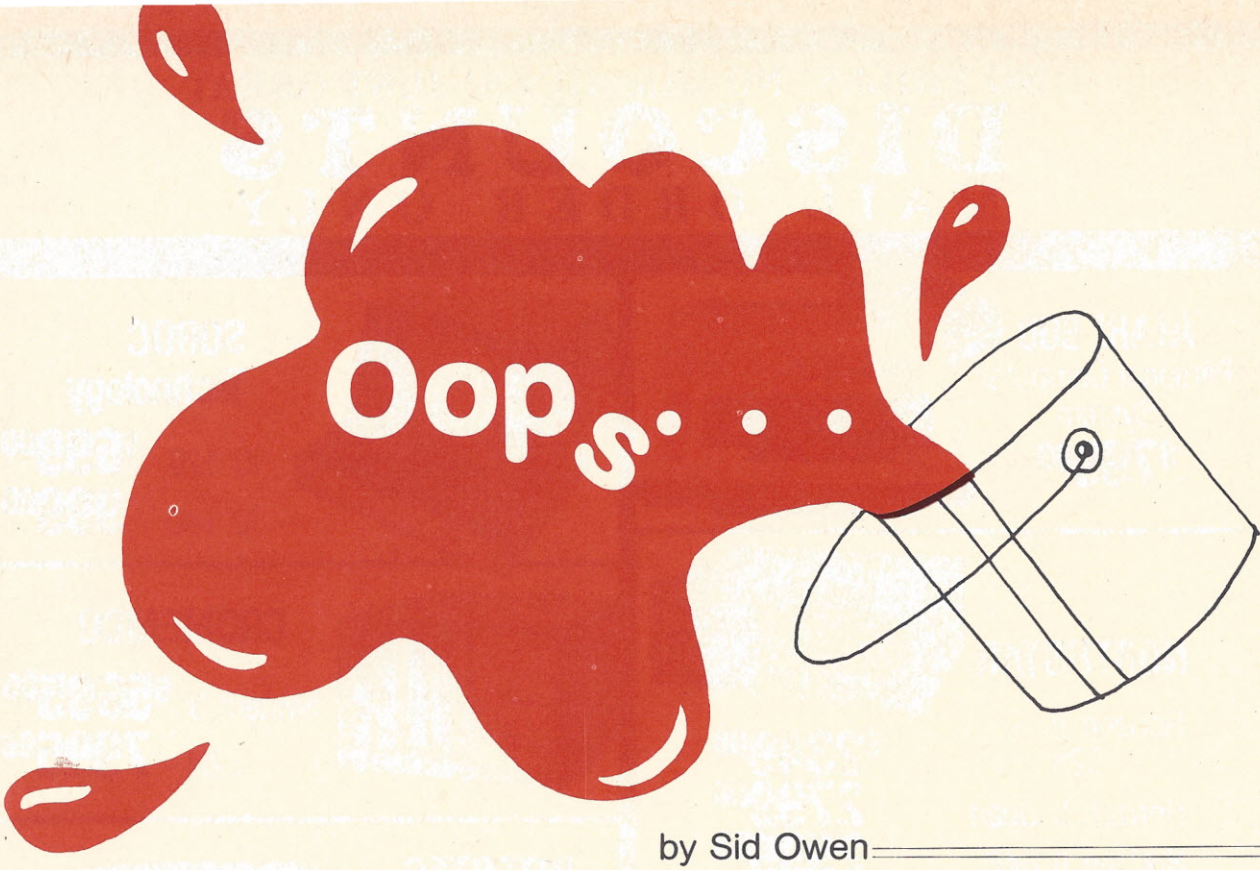
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by Sid Owen

You just deleted the wrong file on your Horizon computer or North Star floppy disk. But take heart, all is not lost; in fact nothing is lost—the file can be completely saved. Of course, important files should always be copied on at least one separate disk, but copies aren't needed to save accidentally erased files that have not been overwritten.

Figure 1 shows an example directory, before and after, where the file named 'data2' is destroyed in error. The important fact is that the 'destroy' command in Basic (or the *DE command in DOS) does not destroy the file; it only deletes the file name in the directory. Even the file data, i.e., size, density, type, remains but, being nameless, this information is not read out with a 'catalog' or *LI command.

The deleted file can be saved intact by simply creating a file in the directory with information identical to the deleted file. This can be done immediately, provided the "before" catalog printout showing the information is available. The 'data2' file could be saved simply by typing (in Release 4 Basic):

```
CREATE "DATA2", 7, 3
```

or in R4 DOS:

```
*CR DATA2 7 84
*TY DATA2 3
```

Release 5 Basic or DOS commands must also include a single or dual density designation. Note that the location specification, 84, in the *CR command is optional.

```
*LI
DOS          4   10    0
BASIC       14   50    1  2A00
PROG1       64    4    2
DATA1       68    3    3
DATA2       84    7    3
DATA3       78    6    3
*DE DATA2
*LI
DOS          4   10    0
BASIC       14   50    1  2A00
PROG1       64    4    2
DATA1       68    3    3
DATA3       78    6    3
*
```

Figure 1. Data2 file can be easily restored.

Since few computerists have the discipline to print out a catalog every time a new file is created, suppose that the 'before' catalog wasn't available. Then the problem is to figure out what it would have said. The file name is not important; any name can be used. It need not be the same as the deleted name—in fact, I have frequently used the 'destroy'-'create' method to rename files.

The destroyed file is located at the end of the previous file. Add the location of the previous file to its size and you have the location of the destroyed file. The size of the destroyed file can now be found by subtracting its location from the location of the next file. That is all the information needed to recreate the file, using a 'create' or DOS *CR command, assuming of course that the file type is known. Location isn't a part of the 'create' command and it is optional for *CR, but it was needed to calculate size.

Overwriting by New Files

Creating a file without writing to it does not destroy any data previously in that location, so to recover from an error, 'destroy' the new file and save the old as described above. If new files have been created and written to after a file is mistakenly deleted, the data (or program) may have been overwritten and permanently lost—maybe not.

When a file is destroyed, the disk data space becomes available. If, as in our example, the data space of the destroyed file, 'data2,' is sandwiched between two other files, it can be overwritten only by an equal or smaller size new file. In other words, new files will be written in the lowest available location with enough space to hold them. Before giving up, delete any new files not yet written to; print out the remaining directory; and write out by hand a list of the remaining files in the sequence of their location, showing start and end locations. Now look for gaps in the list—the accidentally destroyed file name may be intact in one of them.

Disk Identification

It is quite useful, as your disk collection grows, to identify disks so that the identification prints out with the directory. Four methods of identification should be considered:

1. Create a zero length, name only, file:

 *CR DISC = 29 0

 Creation of a zero length file to indicate the disk takes no room, but remember that the compact program, if needed, doesn't work if there are zero length files.

2. Write a 'rem' file with a disk identifying name:

 *CR 29-REM 3
 *TY 29-REM 2

 This is a good practice; use a few blocks for 'rem' in Basic about the files on the disk. Remarks can save a lot of time later. With either this or the first method, the identification will be at the top of a catalog printout only if the identification file is created first (or if the disk includes DOS immediately after DOS) before other files are created.

3. Rename DOS:

 *DE DOS
 *CR DISC = 29 10 4

 The built in boot-up firmware looks for DOS by location, not by name, so the DOS file can have any name without affecting operation. This technique identifies the disk without using disk space and does not preclude compacting later. You can do this on old disks and still have the identification print out first. You can also double name files if you want to forego future compacting. For example, when starting a new disk:

 *CR DISC = 29 10
 *CR DOS 10 4

 You must use the *CR command and specify location for the second name or an unused location will be automatically selected.

4. Name the directory as a file:

 *CR DISC = 29 4 0

 This is the technique used for all disks produced by North Star. I personally use this identification method on all disks, but with the added safety feature of "typing" the file with an unusual number:

 *TY DISC = 29 29

The first four blocks on all disks are automatically dedicated to directory listings. Access to the directory is normally done only by the DOS routines. This is intended to preclude catastrophic errors by the user, but you can circumvent this safety feature by making a file out of the directory as shown above. If you make this file an unusual type, e.g. type 29 in the example, you can access it only by deliberate action—by name and the unusual type. A program later in this article does access this file for useful directory details not otherwise available.

Creation of this disk identification file should be done before other files are created if it is to be listed first in directory printouts.

As mentioned previously, a program is discussed below which uses the fourth method of disk identification for access to directory data. When the program is run, type in the disk identification file name and the file type in order to open the file. Another standard has been incorporated into a number of published utility programs. These programs assume that the directory has been identified as a type 3 file named either <*> or DIR. All disks must have the directory identified with one of these two names, depending on which standard is used.

You can accommodate all these multiple standards by identifying the disk as in method four plus the other names, all for the same directory—that is, three separate file names such as:

DISC = 29	0	4	29	
<*>	0	4	3	
DIR	0	4	3	

Multiple Restorations

Suppose that you were "housecleaning" a disk, destroying many obsolete files, and then discovered when you were done that you had destroyed one or more files you intended to save. The above reconstruction methods are inadequate for this situation, but the files can still be saved.

```
100 REM `DIRECTRY', prints DIRECTORY details
110 REM by S. Owen, 4/2/79
120 REM
130 INPUT "Output device number? ",W
140 INPUT "Disc name?            ",Q$\A1$=Q$
150 INPUT "Name file TYP?        ",Q\A1=Q
160 !#W
170 !#W,%3I,TAB( 9),"DETAILED DIRECTORY, `",A1$,"', TYP ",A1
180 !#W,%#5I
190 !#W," NAME      LOC  SIZE   TYP      LEN  DENS. TDI  TDI"
200 !#W
210 OPEN #1 %A1, A1$
220 FOR K=1 TO 128
230 Z=0\D$="S"
240 FOR J=1 TO 8
250 READ#1, &X
260 !#W,CHR$(X),
270 NEXT J
280 REM
290 READ#1, &X1,&X2,&X3,&X4,&X5,&X6,&X7,&X8
300 !#W,TAB(10),X1+X2,
310 !#W,TAB(16),X3+X4,
320 !#W,TAB(22),X5,
330 IF X6<128 THEN 340\X6=X6-128\D$="D"
340 !#W,TAB(34),X6,
350 !#W,TAB(43),D$,
360 !#W,TAB(45),X7,
370 !#W,TAB(48),X8
380 Z=X1+X2+X3+X4+X5+X6
390 IF Z= 192 THEN EXIT 410
400 NEXT K
410 !#W
420 CLOSE #1
430 END
```

Figure 2. Program prints disk directory details.

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CIRCLE INQUIRY NO. 80

Use the program of figure 2 to read the directory data for saving any destroyed file. This program reads the directory identification file created by the fourth identification method described above and prints out the information for all files, including the destroyed files—less their destroyed names. It even prints out additional information you probably don't need and maybe didn't even know was there. You can then recreate any or all of the destroyed files.

Each directory entry uses 16 bytes. The first eight are dedicated to the file name (even if the name is shorter); then two for location; two for size; one for type and density; and three for 'type dependent information' or TDI, the first TDI byte being file length actually used.

Figure 3 shows an example "before" and "after" printout of the program, where data2, data3, and data4 files were destroyed. With the "after" printout, it is easy to save any of the destroyed files. For example:

```
*CR DATA3 6 78
*TY DATA3 3
```

Now the file is recovered intact.

```
RUN

Output device number? 0
Disc name?            DISC=29
Name file TYP?        29

        DETAILED DIRECTORY, `DISC=29', TYP  29

 NAME       LOC  SIZE   TYP    LEN  DENS. TDI  TDI

DISC=29       0     4    29      4     S    32   32
DOS           4    10     0     10     S    32   32
BASIC        14    50     1      0     S    42   32
PROG1        64     4     2      4     S    32   32
DATA1        68     3     3      3     S    32   32
DATA2        71     7     3      7     S    32   32
DATA3        78     6     3      6     S    32   32
DATA4        84     3     3      3     S    32   32
DATA5        87     7     3      7     S    32   32
             64    64    32     32     S    32   32

READY
DESTROY "DATA2"
READY
DESTROY "DATA3"
READY
DESTROY "DATA4"
READY
RUN

Output device number? 0
Disc name?            DISC=29
Name file TYP?        29

        DETAILED DIRECTORY, `DISC=29', TYP  29

 NAME       LOC  SIZE   TYP    LEN  DENS. TDI  TDI

DISC=29       0     4    29      4     S    32   32
DOS           4    10     0     10     S    32   32
BASIC        14    50     1      0     S    42   32
PROG1        64     4     2      4     S    32   32
DATA1        68     3     3      3     S    32   32
             71     7     3      7     S    32   32
             78     6     3      6     S    32   32
             84     3     3      3     S    32   32
DATA5        87     7     3      7     S    32   32
             64    64    32     32     S    32   32

READY
```

Figure 3. The directory before and after several deletions.

Even if the disk wasn't previously identified using the directory identification file technique, restoration is simple. First create the identification:

```
*CR DISC = 29 4 0
*TY DISC = 29 29
```

Then run the figure 2 program. The only difference from the previous example is that the file named disc = 29 and its associated data will appear on the detailed directory printout where the first deleted file data was—that is, the disc = 29 name and file information overwrites the data2 information in the directory, but no data in the file was overwritten. The deleted data2 file filled the gap between program1 and the deleted data3 file, whose file information is still printed out. Jot down or print out the information about the deleted files and then proceed to recreate any of them in the directory.

The sequence of names in the directory does not have to be the same as the sequence of files on the disk. When a file is opened, the system finds the name in the directory and reads the location information beside that name. The directory and DOS are exceptions. The directory data must occupy the first four sectors (0-3) and DOS must start at sector 4. File names for either, however, can be anywhere in the directory.

Warning! Writing to a directory file, created for disk identification and for readout or directory data, can cause problems beyond the scope of this article. That is why it should be given an unusual number. □

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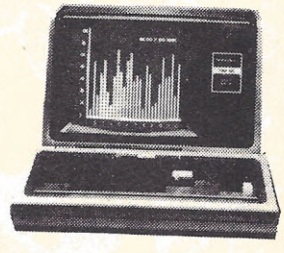
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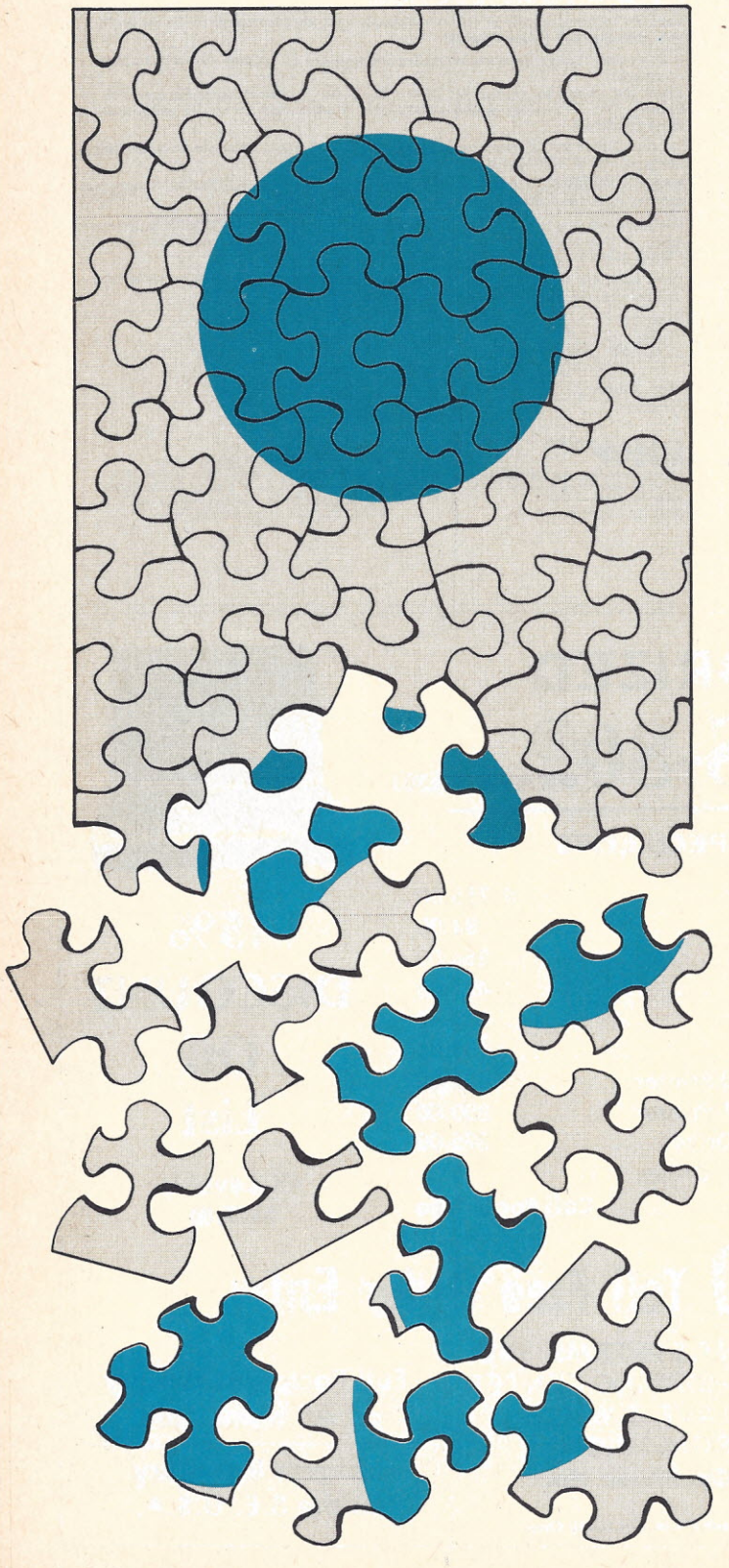
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Formatting Integer Basic Programs

by R. F. Zant, Ph.D.



The colon is used in Basic to place multiple statements on a single line. In Applesoft and other Microsoft Basics, the colon can also be used to format statement listings such as the program segment in figure 1. Lines 100 and 160 demonstrate the vertical spacing of statements, while line 140 demonstrates the indentation of statements in the range of a 'for. . .next' loop. Such formatting of program statements improves the legibility of a program listing, facilitating both debugging and modification.

```
100  REM  SUM N NUMBERS
110 :
120  LET S = 0: REM  START SUM AT ZERO
130  FOR I = 1 TO N
140 :: LET S = S + I
150  NEXT I
160 :
```

Figure 1. Formatted Applesoft

An unfortunate characteristic of Apple's integer Basic system is that the use of colons in formatting statements is considered to be a syntax error. The input processor rejects the statements and will not add them to a Basic program. Integer Basic programs can be formatted, however, with the assembly language routine described below.

To create a formatted program, a syntactically correct, but unformatted, program is entered (figure 2). Lines that are to contain only a colon are entered as 'rem' statements with no text (not even a blank). The 'rem' command will later be replaced by a colon (figure 3). Lines to be indented are begun with the graphics command 'GR:' followed by the Basic statement desired. The graphics command will later be replaced by a colon, leaving a statement that begins with two colons (figure 3).

```
100 REM  SUM N NUMBERS
110 REM
120 LET S=0: REM  START SUM AT ZERO
130 FOR I=1 TO N
140 GR : LET S=S+I
150 NEXT I
160 REM
```

Figure 2. Integer Basic before translation

```
100 REM  SUM N NUMBERS
110:
120 LET S=0: REM  START SUM AT ZERO
130 FOR I=1 TO N
140:: LET S=S+I
150 NEXT I
160:
```

Figure 3. Integer Basic after translation

After the Basic program is entered, the integer format program in locations 770 to 834 is executed by the immediate command 'call 770' (figure 4). The integer format program scans the Basic program replacing null 'rem' statements and 'gr' statements with colons. However, 'gr' statements are only replaced if they begin with a line and are followed by a colon. Thus, graphic statements can still be used in a formatted program.

```
1000 *  INTEGER FORMAT
1010 *
1020 *  ROUTINE TO FORMAT
1030 *  INTEGER BASIC PROGRAMS
1040 *  FOR THE APPLE II
1050 *
1060 *  WRITTEN BY:
1070 *  ROBERT F. ZANT
1080 *
1090 *  06-10-79
1100 *
1110 *  ASSEMBLED USING
1120 *  S-C ASSEMBLER II
1130 *
1140 *  PROGRAM WILL CHANGE
1150 *      10 REM
1160 *      20 GR:PRINT A$
1170 *  TO
1180 *      10 :
1190 *      20 :: PRINT A$
1200 *
1210 *  'REM' FOLLOWED BY TEXT WILL
1220 *        NOT BE CHANGED
1230 *  'GR'  USED ALONE WILL NOT
1240 *        BE CHANGED
1250 *
1260 *  'REM' AND 'GR' ARE CHANGED
1270 *  ONLY WHEN THEY BEGIN A LINE
1280 *
1290 *
1300 *
1310 *  TO USE:
1320 *    1 ENTER INTEGER BASIC PROGRAM
1330 *    2 BLOAD FORMAT PROGRAM
```

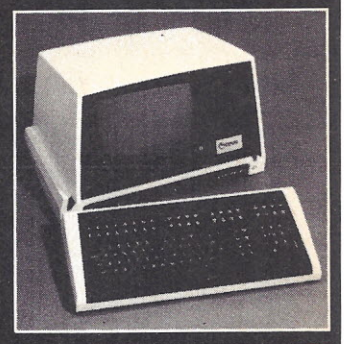

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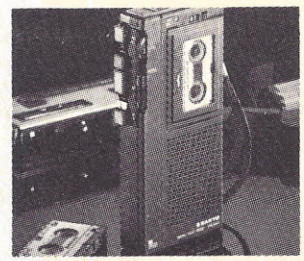
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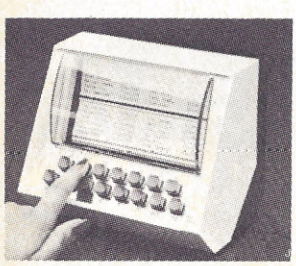
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```
1340 *     3 CALL 770
1350 *
1360 *
1370 HIMEML  .EQ $4C
1380 HIMEMH  .EQ $4D
1390 PENDL   .EQ $CA
1400 PENDH   .EQ $CB
1410 SL      .EQ $3C
1420 SH      .EQ $3D
1430 *
1440         .OR $302
1450 *
1460         LDA PENDL    POINTER TO
1470         LDY PENDH    FIRST LINE
1480         STA SL
1490         STY SH
1500 *
1510 LOOP    LDY #$03     SKIP LINE #
1520         LDA (SL),Y   GET FIRST TOKEN
1530         TAX          PUT IT IN X
1540         INY
1550         LDA (SL),Y   GET NEXT TOKEN
1560         DEY          FIRST TOKEN
1570         CPX #$5D     REM?
1580         BNE GR
1590         CMP #$01     ALONE
1600         BNE NXLINE
1610         LDA #$03     SUBSTITUTE ':'
1620         BNE STORE    BRANCH ALWAYS
1630 GR      CPX #$4C     GR?
1640         BNE NXLINE
1650         CMP #$03     THEN ':'?
1660         BNE NXLINE
1670 STORE   STA (SL),Y   NEW TOKEN
1680 *
1690 NXLINE  LDY #$00
1700         CLC
1710         LDA (SL),Y   UPDATE POINTER
1720         ADC SL       TO NEXT LINE
1730         STA SL
1740         BCC TEST
1750         INC SH
1760 TEST    CMP HIMEML   TEST FOR
1770         BNE LOOP     END OF
1780         LDA SH       PROGRAM
1790         CMP HIMEMH
1800         BNE LOOP
1810 *
1820         JMP $FBE2    BELL & RTS
1830         .EN
```

Figure 4. Integer format routine

A formatted program can be listed, executed, and modified as a regular Basic program. If the program is modified, the integer format program can be used again to format the new statements.

The integer format program does not supply all formatting possibilities available in Applesoft, but its use will improve the legibility of programs. □

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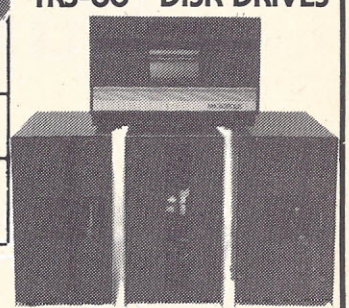
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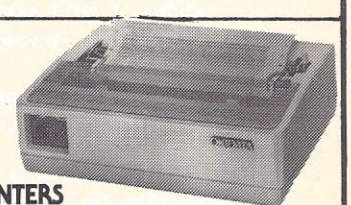
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Subroutine COLUMNS for the TRS-80

by Daniel Jacob

The TRS-80's standard printout formats are either a horizontal succession of four items, each allocated to a predetermined print zone, or one vertical column of items.

Both formats are lacking when it comes to analyzing a printout consisting of a large number of closely related data.

For example, when analyzing a printout for maxima and/or minima, it isn't convenient to follow the trend in data horizontally, having also to switch lines every four items.

It is much easier to see a trend in data when the items are stacked successively in a column because:

a) when the items are in a line, the tail end of each item is followed by the beginning of the next item, making it difficult to compare "heads with heads" and "tails with tails."
b) more often than not, variations in data are small and it is good to have each digit of an item as close as possible to the corresponding digits in the adjoining items.

As for the standard one-column format on the TRS-80 (and maybe other computers, too), it is a very inefficient use of the screen. Furthermore, both formats automatically disappear from the screen as the display reaches the bottom.

The subroutine to be described herein eliminates four of the limitations mentioned above:

a) allows printing of vertical successions of data
b) columns are automatically tailored for spacing
c) efficient use of the screen
d) when the screen is filled, it halts further printing until a special command is issued.

In a nutshell, the subroutine measures each item before it is printed and retains in memory the maximum cursor position in each column. With this information, the subroutine determines where the next column begins.

The computer is instructed to start printing at an artificial home position, location 128, and to continue downwards always comparing the most recent cursor position to the one remembered from the last printing. If the most recent cursor position is larger, it is the one retained in memory next.

When the printout reaches the bottom of the screen, the computer is instructed to shift the cursor three spaces to the right of the cursor position in memory, and to the artificial top of the screen: this creates the position of the new column. This position is also retained in memory.

Having the position of every new column in memory and knowing the length of the next item, the subroutine determines whether or not there is enough space for the next item on the screen.

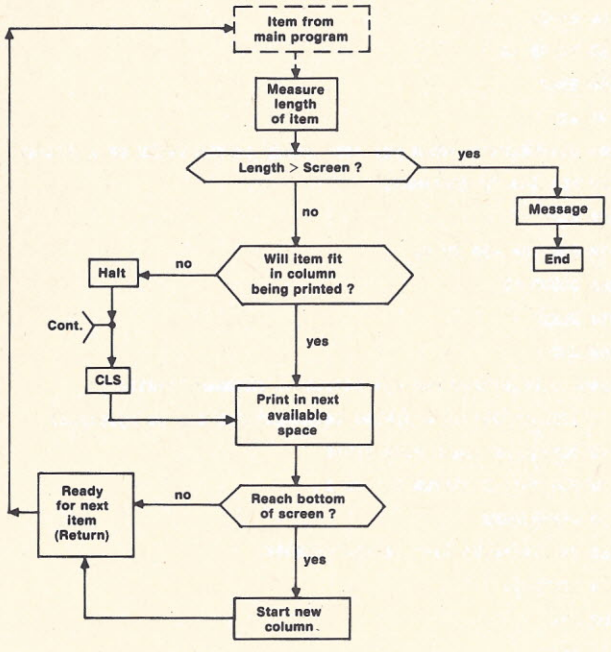


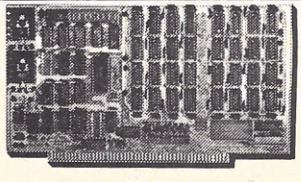
Figure 1. Flow diagram

If there isn't enough space, the subroutine halts printout and issues an instruction on how to continue. Hitting 'C' then results in a 'CLS' (clear screen) and the continuation of printing, starting with the item which wouldn't fit in the last printout.

Figure 1 is a flow diagram of the subroutine, figure 2 is the program listing, and figure 3 is a listing of some sample programs which demonstrate the use of subroutine "Columns."

```
 9 GOTO 24
10 PRINT@0,CHR$(30)
11 ON ERROR GOTO 12:QL=LEN(PR):ON ERROR GOTO 0:GOTO 13
12 QL=LEN(STR$(PR)):RESUME 13
13 IF QL>63 THEN PRINT@0,"RESULT IS TOO LONG."
   :PRINT"REDO PROGRAM.":END
14 IF QB+QL>64 THEN 21
15 QS=QP+128
16 PRINT@QS,PR;
17 IF POS(0) QC THEN QC=POS(0)
18 QP=QP+64
19 IF QS>959 THEN 20 ELSE RETURN
20 QP=QC+3:QB=QP:RETURN
21 QB=0:QC=0:QP=0:PRINT@0,"TO CONTINUE, HIT 'C'"
22 IF INKEY$ ="C" THEN 23 ELSE 22
23 CLS:GOTO 15
24 PRINT;
```

Figure 2. Program listing for Subroutine Columns

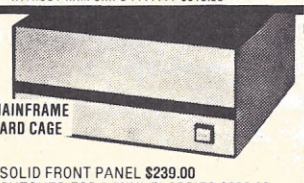


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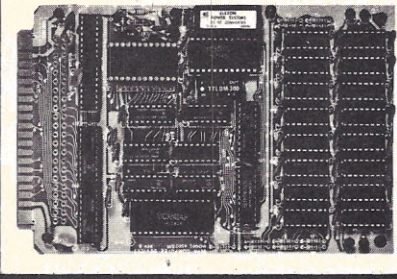
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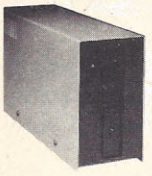
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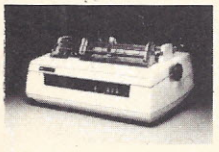
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```
100 CLS:PRINT"PROGRAM #1: DEMONSTRATES SIMPLE COLUMN LISTING."
    :PRINT:PRINT"'PR' TAKES ON THE VALUE OF 'I'"
110 PRINT:PRINT:PRINT:PRINT"HIT 'R' TO RUN"
120 IF INKEY$<>"R" THEN 120 ELSE 130
130 CLS:FOR I=0 TO 20000 STEP 100
140 PR=I
150 GOSUB 10
160 NEXT
170 END
200 CLS:PRINT"PROGRAM #2: 'PR' TAKES ON THE VALUE OF A NUMBER"
210 FOR I=0 TO 2500:NEXT
220 CLS
230 FOR PR= -50 TO 50
240 GOSUB 10
250 NEXT
260 END
300 CLS:PRINT"PROGRAM #3: FACTORIAL PROGRAM.":PRINT
    :PRINT"'PR' IS A STRING VARIABLE":FOR I=0 TO 2500:NEXT
310 CLS:CLEAR 100:DEFSTR P:F=1
320 FOR I=1 TO 33:FOR N=1 TO I
330 F=F*N:NEXT
340 PR="I="+STR$(I)+"  F(I)="+STR$(F)
350 GOSUB 10
360 F=1
370 NEXT
380 END
400 CLS:PRINT"PROGRAM #4: GENERATES RANDOM LENGTHS OF NUMBERS."
    :PRINT"STOPS WHEN 3 CONSECUTIVE NUMBERS ARE IDENTICAL":
    PRINT:PRINT:PRINT"HIT 'R' TO RUN"
410 IF INKEY$<>"R" THEN 410 ELSE X=X:CLS:DEFSTR P:RANDOM
420 N=INT(RND(20000)/2300)+1:IF N>9 THEN 420
430 PR=STRING$(N,N+48):GOSUB 10
440 IF N=M AND N=C THEN PRINT@0,"HIT 'R' TO RE-RUN":RUN 410
450 C=M:M=N:GOTO 420
500 CLS:PRINT"PROGRAM #5: TAKES YOUR X AND Y INPUTS AND RETURNS"
    :PRINT"Z=X↑2+Y":PRINT:PRINT:PRINT"HIT 'R' TO RUN"
510 IF INKEY$<>"R" THEN 510 ELSE CLS
520 CLEAR 200:DEFSTR P
530 INPUT"ENTER X,Y   ";X,Y
540 PR="X="+STR$(X)+"  Y="+STR$(Y)+"  Z="+STR$(X↑2+Y)
550 GOSUB 10:GOTO 530
600 CLS:PRINT"PROGRAM #6: LISTS ANGLES AND THEIR SINES FROM";
    :PRINT" 0-360":PRINT"IN INCREMENTS OF 5 DEGREES":PRINT:PRINT
    :PRINT"HIT 'R' TO RUN":DEFSTR P
610 IF INKEY$<>"R" THEN 610 ELSE CLS
620 FOR I=0 TO 360 STEP 5: A=.017453292*I
630 PR=STR$(I)+") "+STR$(SIN(A))
640 GOSUB 10
650 NEXT:END
700 CLS:DEFSTR P:PRINT"PROGRAM #7: LISTS NUMBERS THE LENGTHS OF";
    :PRINT" WHICH ARE PROPORTIONAL":PRINT"TO THE SINE FUNCTION"
    :PRINT:PRINT:PRINT"HIT 'R' TO RUN"
710 IF INKEY$<>"R" THEN 710 ELSE CLS
720 FOR I=0 TO 10 STEP .6
730 X=9*SIN(I)+10
740 IF I 6.28 THEN I=0
750 PR=STRING$(X,X/2+48):GOSUB 10:NEXT
```

Figure 3. Sample programs

The following is a line-by-line explanation of the subroutine listing:

9 & 24: Diverts all 'run' statements to the main program.

10: Erases the uppermost line on the screen. This is in order to erase input values which may have been entered.

11 & 12: Obtains the length of the next item along with an error-trapping routine. If PR, the item to be printed, is a numerical variable, there will be an error in line 11 (because then LEN(PR) will be invalid), and execution will be diverted to line 12 because of the 'on error goto 12' statement. Line 12 will then be a valid statement, and QL, the length of the item, is obtained. 'Resume 13' returns error-trapping to the normal mode, and diverts execution to line 13. If PR is a string variable, line 11 is valid; 'on error goto 0' nullifies the 'on error goto 12' statement so that normal error-trapping is resumed, and execution is diverted to line 13.

13: If the length of PR is more than 63 spaces, a message is issued and the program is ended.

14: Tests whether the item to be printed next will fit into the current column being printed. If it won't fit, execution is diverted to line 21 which, together with lines 22 and 23, sets all cursor control variables to zero, prints out an instruction for continuing, halts further execution, and waits till 'C' is hit, upon which the screen is cleared and printing is resumed by the diversion to line 15.

15: Creates an artificial home position two lines lower than the normal home position by adding 128 to the new cursor position stored in QP. QS is the new printing position.

16: Simply causes PR, the next item to be printed, to be printed at position QS.

17: Obtains maximum cursor position in each column and assigns this value to QC.

18: Prepares a new printing position at the next line of the current column by adding 64 to the cursor-control variable QP. Here, also, the cursor is brought to the real home position before returning control to the main program so that any input displays will occur at the top of the screen and not where the last printout took place.

19: Checks whether printing has reached the bottom of the screen. If so, line 20 increments cursor-control variable QP, three spaces to the right of the maximum printing position in the last column, and to the top of the screen. This new position is stored in QB to be used in line 14. The last statement in line 20 returns control to the main program.

How to Use

Loading: Load the subroutine before you start programming the main program. Program instructions may start at line 25.

Printing: The variable PR must contain the item to be printed. PR may be either a numerical variable or a string variable.

When it is desired to print PR, call the subroutine by 'gosub 10.'

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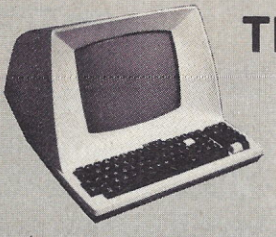
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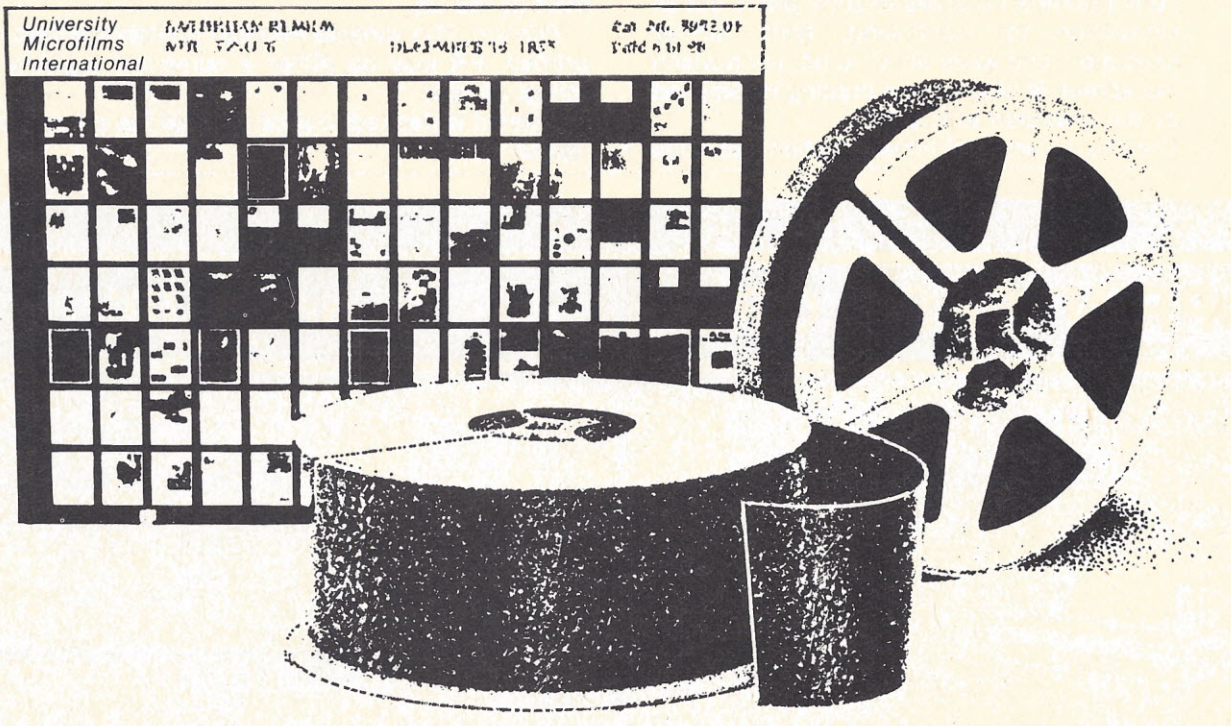
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Inputs from keyboard: Inputs should be separated by commas and entered all at once. Entry of inputs one at a time will result in the erasure of printout data.

Avoid using any variables beginning with 'Q' in your program: all variables in subroutine columns begin with 'Q' except for the variable PR. Reserved variables in subroutine "Columns" are: QB,QC,QL,QP,QS.

Let's list some programs to illustrate the use of subroutine "Columns." Figure 3 is a program listing of seven subprograms, each of which begins at a 100's number from 100 to 700. Line 100 is the beginning of program #1, etc.

You don't have to list all of them, only those you would like to see.

#1) Demonstrates simple column listing with PR taking on the value of another variable.
#2) PR is placed directly into a 'for-next' loop.
#3) Factorial program. PR is a string variable.
#4) Generates random lengths of numbers, and stops when three consecutive numbers are identical. PR is a string variable. (Good demonstration of automatic column spacing.)
#5) Demonstrates how to use the 'input' command with the subroutine.
#6) Lists angles and their sines every five degrees.
#7) Lists numbers, the lengths of which are proportional to the sine function.

Try some of these programs, then write some of your own using the subroutine. See how convenient subroutine "Columns" is when you have a continuous printout of data and you don't have to place the data or worry about it rolling off the screen. □

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Graphics Tablet	679.00
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Centronics Printer Int. card	179.00
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Interger BASIC Firmware Card	155.00
* Novation CAT Modem	179.00
* Apple Clock Card	249.00
* ABT Apple numeric key Pad	115.00
* ALF Apple Music Card	239.00
* D. C. Hayes Modem II	345.00
* Corvus 10 Megabyte Hard Disk Drive For Apple II	4499.00
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OTHER ACCESSORIES	
Sup 'R' Mod R. F. Modulator	$29.00
Visi Calc (software disk)	120.00
Apple Bowl (software disk)	14.00
Computer Bismarck (software disk)	49.00

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OTHER COMPUTER SYSTEMS: (shipping included)

ATARI Computers	
400 (w) 8K	$475.00
800 (w) 8K	795.00
North Star Computers	
Horizon II 32K D/Den (Assembled) with all options	2361.00
Horizon II 32K D/Sid D/Den (Assembled) with all options	2650.00

PERIPHERALS: (shipping included)	FUTRA Price
NEC "Spinwriter"	
5510 R/O, RS232 (w) Tractor, thimble & ribbon. 55 CPS	$2595.00
Texas Instrument	
825 R/O, RS232 (w) Tractor. Basic Printer. 75 CPS	1249.00
Integral Data Systems	
IDS-440G "Paper Tiger" (w) Factory Warrantied Graphics	889.00
Annadex	
DP-8000, Standard 80 column version. RS232 & Parallel input	835.00
DP-8000-AP, "Apple/Sider" 96 column version. Parallel only	795.00
Trendcom	
Trendcom 200, (80 column thermal) High resolution graphics ability	549.00
Trendcom Apple interface	75.00
Apple	
"Silentype" (96 column thermal) Apple Computers version of Trendcom 200. Incld. Special Apple Interface.	555.00
ADDS	
Regent 25 CRT Terminal	895.00
Leedex	
Video 100, 12" B/W Monitor	143.00
Sanyo	
4509, 9" B/W Monitor	190.00
Base 2	
RS232 & Parallel (w) Tractor 2K buffer, FULLY LOADED	599.00
Hazeltine	
1500 CRT Terminal	997.00
Soroc	
IQ-120 CRT Terminal (w) commercial grade keyboard.	985.00
Texas Instrument	
820 KSR, RS232 (w) Tractor. VFC & Compressed Print. 180 CPS	1995.00

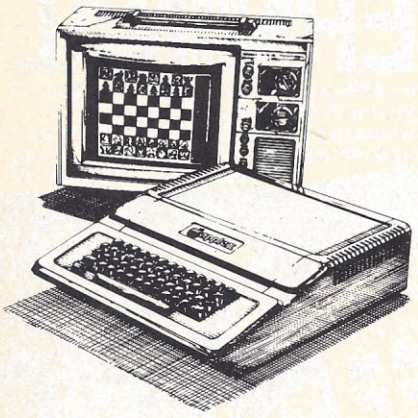
DATA SUPPLIES

Memorex Diskettes	
5 ¼" Diskettes 0, 10 or 16 sector. Box of 10	$27.00
8" Diskettes 0 or 32 sector. Box of 10	32.00
3 ring Vinyl Diskette Sleves Each holds (2) 5 ¼" diskettes. Package of 10	6.95

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CIRCLE INQUIRY NO. 77

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CIRCLE INQUIRY NO. 70

NEW PRODUCTS

A report writing utility, Micro Writer, that enables users to catalog report formats and specifications involves calling the report run time, specifying the report name from the file catalog, and receiving the desired report on the printer. The entire system is written in 6800 assembler to obtain the best performance for production reporting. The system turns your printer into a sophisticated printing facility by keeping track of headings and footings for each page, performing control headings and footings according to your specification, and generating any number of total accumulations you desire. The product uses a Cobol oriented language syntax to describe file formats, control structures, and detail portions of the desired report. File structures supported are both variable length (e.g. Basic) and fixed length/fixed field (e.g. Fortran, Cobol, Bal). Editing is provided for numeric data items and includes fixed dollar, floating dollar, decimal point insertion, zero suppression, and editing around any masked character supplied. Ripley Computers, 126 N. Main St., Souderton, PA 18964, (215) 723-1509.
CIRCLE INQUIRY NO. 121

Stock market charting and analysis for the Apple II, Market Charter, is a technical analysis package for following stocks and commodities. The program features 'hi-lo-close' charts, negative and positive volume indicator charts, volume charts, and comparison charts. Any simple, exponential, or weighted average can be plotted, as can trend lines, speed resistance lines, horizontal lines, and trading bands. Hard copy of the charts and data can be obtained. A versatile file maintenance program allows for the creation and updating of the database, adjusts for stock splits, etc. RTR Software, P.O. Box 12351, El Paso, TX 79912, (915) 544-4397.
CIRCLE INQUIRY NO. 122

Software package for dentists handles patient records of charges, payments, insurance, delinquent accounts, and daily and monthly transactions. It prints out patient statements and standard insurance forms for the American Dental Association. The package can be ordered on standard 8-inch disk or various minifloppy disks, and includes software in INT and BAS file form plus a user's manual and hard copy source listing for easy customizing. Storage capacity on 8-inch single-density disk drive: 1200 patient records and 2100 treatment and payment records. Graham-Dorian Software Systems, 211 N. Broadway, Wichita, KS 67202, (316) 265-8633.
CIRCLE INQUIRY NO. 123

Package for translating Basic programs to Fortran (and vice versa), Convert, allows simple conversion of software written for DEC, Prime and any other ANSI standard Fortran system into microcomputer compatible Basic. Free software has been produced by users groups and may now be utilized by microcomputer owners. Additionally, microcomputer programmers may translate their Basic routines into Fortran for large system use. The translator is available in two versions: version I is written in Basic and version II in Fortran. Both will operate on all computers with a Basic or Fortran compiler and a minimum of 8K. Price $115 postpaid. Cognitive Electronics Laboratory, P.O. Box 615, New Braunfels, TX 78130, (512) 625-9627.
CIRCLE INQUIRY NO. 124

Structured programming constructs for Z80 and 8080 assembly programming using CP/M is available for several assemblers including Microsoft Macro-80, Digital Research MAC, CDL/TDL macro assembler, and the Cromemco ASMB macro assembler. SPZ80 and SP80 provide 'do' for count iteration, 'ifthen-else' for alternate path conditions, 'select-case-case' and 'select-option-option' for case analysis, 'repeat-until' and 'while-endwhile' for looping as well as a 'loop-exitif-exitif-endloop' with multiple exits from embedded loops. All conditions (predicates) may include signed and unsigned relations (EQ, NE, LE, LT, GE, GT) and conditions code testing. Conjunction (AND) and disjunction (OR) may be used to specify multiple conditions or relations. SPZ80 and SP80 generate efficient code which is ROMable. A user's manual, CP/M compatible 8-inch diskette, and laminated reference card cost $95 (add $5 for overseas and $2 for Canadian postage). Structured Analysis Systems, Box 2745, Reston, VA 22091.
CIRCLE INQUIRY NO. 125

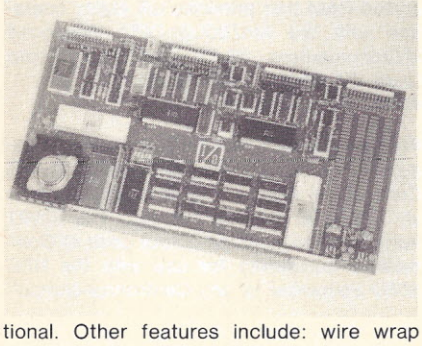
Mathematics instruction, drills and games—17 programs of them—run on TRS-80 and Apple II computers, and include graphing, algebra, and arithmetic programs and games. The programs have been used and refined in actual classroom applications. The programs include the "Alphabet Song" on the Apple and a sketching screen with graphics code output for the TRS-80. For computer programming classes, there is a simulated machine language computer, implemented on the TRS-80 screen. The 17 programs are contained on five different tapes, two for the Apple and three for the TRS-80 I. Tapes cost $9.95 each plus $1 per order shipping and handling. Free catalog available. Steketee Educational Software, 4639 Spruce St., Philadelphia, PA 19139.
CIRCLE INQUIRY NO. 126

Real estate index and locator is a system of Basic programs designed to assist real estate agencies find properties for customers. These interactive search and sort programs, called Reiley, automatically match home specifications of a prospective buyer with current active MLS listings. No complicated codes or symbols are required to access information, nor is computer expertise necessary. The system gives comparisons of mortgage terms, access detailed property descriptions, print complete amortization tables, estimate the monthly payment and sale price which the buyer can afford, and determine the replacement price of any

home on the MLS file. The program is initially being made available for the North Star disk system, but will also be released in Applesoft Basic, CBasic-2, Radio Shack Basic and IBM 5100 Basic. The Electric Abacus, 19 Mayfield Rd., Regina, Saskatchewan S4V 0B7, Canada.

CIRCLE INQUIRY NO. 127

Multi-function S-100 I/O board has two serial ports async/sync (RS-232, current loop or TTL) with individual crystal controlled programmable baud rate generators. Four 8-bit paralleled ports are available: a latched input port and three that can be programmed in combinations of input, output or bidirec-



tional. Other features include: wire wrap posts for easy port configuration; completely socketed; an on-board clock divisor for timers; and an 8-level programmable interrupt controller with auto restart (8080/Z80). Price $375 each. I/O Technology, 29119 Flowerpark Dr., Canyon Country, CA 91351, (805) 252-7666.

CIRCLE INQUIRY NO. 128

Direct connect auto-answer modem, the M103-A, is an originate, answer, auto-answer modem compatible with the Bell 103A and 113B modems and connects directly to the telephone network using the conventional RJ11C modular phone jack, eliminating the cost and need for a Bell DAA (data access arrangement). Operates from 0-450 baud and allows any terminal with an



RS232 or 20mA interface to automatically answer incoming phone calls, establish a data link and receive or transmit information during early morning or evening hours to reduce phone costs without the aid of a terminal operator. Price $316 with discounts for OEMs, distributors and quantity purchases. Modtech, Inc., 1958 Helsinki Way, Livermore, CA 94550, (415) 447-9349.

CIRCLE INQUIRY NO. 129

Direct-connect modem for TRS-80, named Lynx, is a total telephone linkage system in one package, eliminating the need for a separate expansion interface, interface board, telephone coupler and communications software. Priced at $239.95 (less tax) it includes "terminal" program on cassette,



instruction manual and power pack. No acoustic coupler is used. It includes originate and answer capability, and is programmable for word length, parity, number of stop bits and full or half duplex. Minimum hardware requirements are a TRS-80 I or II with 4K RAM. Emtrol Systems, 1262 Loop Rd., Lancaster, PA 17604.

CIRCLE INQUIRY NO. 130

Two bidirectional printers, specified at 125 cps, 80- and 120-columns, support the full upper and lower case 96-character Ascii set in three software-selectable fonts (5, 10, and 15 CPI) on original plus three copies. The 10 CPI font uses a 9x7 dot matrix. The pin feed paper-handling system can be adjusted to accept fan-fold forms of varying



widths. Forms length is software programmable in one-line increments. The vertical format unit features top-of-form control, up to 10 vertical tab settings, and a skip-over-perforation capability. Paper can be loaded from the bottom or rear. Prices: MT-80P Centronics-compatible parallel interface version $795; MT-80S serial (RS-232) version $895. Microtek, Inc., 9514 Chesapeake Dr., San Diego, CA 92123, (714) 278-0633.

CIRCLE INQUIRY NO. 131

Random access modem for in-house data distribution applications does away with traditional cabling requirements. Ram-11 utilizes advanced carrier current techniques to transmit digital information over AC power lines with low bit error rates. Wireless random access offers versatility in interconnecting electronic office products and data



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Software Dynamics Compiler
The SD Compiler Basic is the most well developed basic for the 6800. Some of the more notable features include: Formatted Print Statements, If Then Else & While Do, variable names up to 15 characters and high speed execution. Both random and sequential device I/O can be done, in either binary or ASCII mode for data flow control to the byte. Now available for Flex II, Flex I, and SSB Flex II. Package includes: Basic Compiler, Mal Assembler (with extensive manuals for each), run time package and 4 misc. utilities. Call or write for detailed catalog. Dealer inquiries invited.
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6800 Forth
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6800 Hardware:
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M-32X 32K Memory Board $539.00

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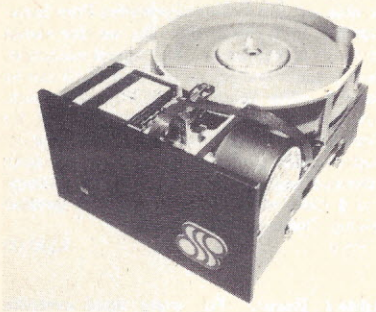
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CIRCLE INQUIRY NO. 71

terminals, allowing random formation of data paths by simply plugging into an AC power outlet. The asynchronous unit is capable of full duplex transmission at up to 9600 bps. An RS-232C interface is standard. Free standing and multi channel rack mount versions are available. Data-Control Systems, P.O. Box 860, Commerce Dr., Danbury, CT 06810, (203) 743-9241.

.CIRCLE INQUIRY NO. 132

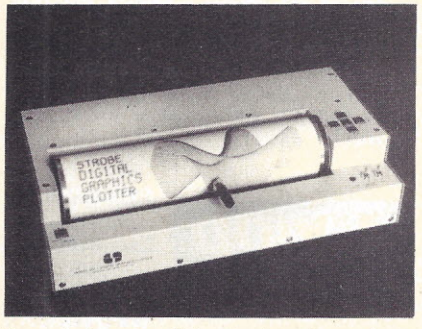
5¼-inch micro-Winchester, model ST506, stores 6.38 megabytes, unformatted data, accesses data in 170 milliseconds and transfers data at 5.0 megabits per second. If the system has two minifloppies, the designer can replace one with a micro-Winchester. Voltage requirements are the same. The simple interface is compatible with cur-



rent floppy and minifloppy designs. A single controller can handle both drives. The series uses standard Winchester head technology. Data is recorded at approximately 7500 bpi, a higher density than double-sided 8-inch floppy, but less than the highest capacity 8-inch Winchester. Price $1500 for single units used for OEM evaluation. Shugart Technology, 340 El Pueblo Rd., Scotts Valley, CA 95066, (408) 438-6550.

CIRCLE INQUIRY NO. 133

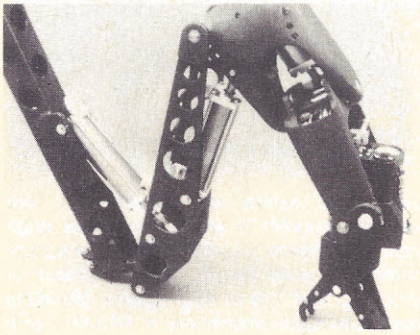
Digital graphics plotter has a 0.004 inch step size, an 8½ x 11 inch paper capacity, and accepts a wide variety of pens. Also features an interactive digitizing mode that allows the user to enter X-Y coordinate data corresponding to pen location directly into the host computer. The Model 100 plotter is controlled directly by the user's computer



through two parallel output ports and one parallel input port. Hardware interfaces and software drivers are available for Apple II, TRS-80, PET, and S-100 bus machines. Also offered is a plot software package providing vector generation and alphanumerics that runs with most versions of Basic and Fortran. Price $680. Strobe Inc., 897-5A Independence Ave., Mountain View, CA 94043.

CIRCLE INQUIRY NO. 134

Industrial undersea robots and remotely operated vehicles and manipulator systems include spatially correspondent and force feedback configurations. Simple pick and place configurations up to programmable microprocessor controlled configurations



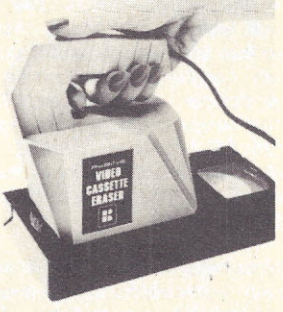
are available. Systems engineering to develop complete manufacturing or assembly stations around the robots is also offered. International Submarine Engineering, 2601 Murray St., Port Moody, B.C., Canada V3H 1X1, (604) 931-2408.

CIRCLE INQUIRY NO. 135

Reinforcer rings to protect standard flexible disks, prevent hole tearing, and reduce the coating removal and rippling damage that causes premature flexible disk failure. Made of manufacturer-weight mular, the rings are for use with Wang and other drives requiring reinforced standard flexible disks. Misco Inc., 963 Holmdel Rd., Box 399, Holmdel, NJ 07733, (201) 946-3500.

CIRCLE INQUIRY NO. 136

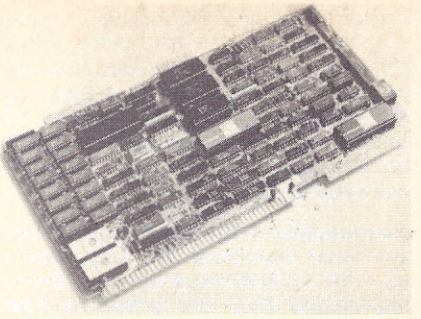
Magnetic tape eraser is designed to erase (in seconds) virtually all signals from computer cassettes and floppy disks without encoded signals. The user sweeps the unit over the disk or cassette and a magnetic field cleans all recorded signals. Size is 5



by 3½ inches; weight is 4 pounds; operates on 110-120 volts AC and is designed for intermittent duty. Price is $58.50. Robins Industries, 75 Austin Blvd., Commack, NY 11725, (516) 543-5200.

CIRCLE INQUIRY NO. 137

Multibus-compatible single-board computer, the AM96/4116, uses the exceptional 16-bit processing power of the AmZ8002 microprocessor. Auxiliary support for the AmZ8002 includes 32K bytes of dual ported RAM, 8K bytes of PROM sockets, two serial and three parallel I/O ports, five high-speed programmable counter/timers and a multiple-mode interrupt response capability. Included is a powerful instruction set with eight addressing modes and eight data



types, including string handling functions. On-board memory includes 32K of dual-ported RAM that provides full 4MHz operation with the AmZ8002 CPU. Advanced Microcomputers, 3340 Scott Blvd., Santa Clara, CA 95051, (408) 988-7777.

CIRCLE INQUIRY NO. 138

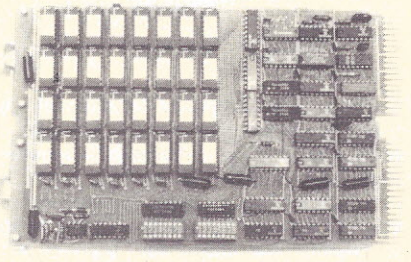
Printer adapter for PET provides letter-quality, low-cost word-processing using Commodore PET and CBM computers with an IEEE-488 printer adapter. The C101 translates the modified output code of Commodore computers for use with the NEC 5530 Spinwriter or any Centronics-compat-



ible parallel-input high-speed dot matrix printers. The adapter complies with all IEEE-488 bus specifications. Price is $225 with 18-inch IEEE cable and six foot printer ribbon cable. FI Electronics, 968 Piner Rd., Santa Rosa, CA 95401, (707) 527-0410.

CIRCLE INQUIRY NO. 139

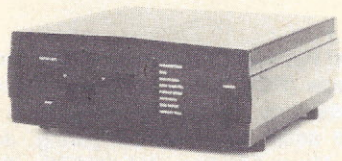
Memory module for the Heathkit/Digital H11, LSI 11/2, and PDP 11/03 features an 8K x 16 dual width board using 200ns 4027 4K x 1 dynamic memory devices or a 32K x 16 dual width board using 200ns 4116 16K dynamic memory devices. The CI-1103 plugs directly into the computer, is available



with on-board distributed refresh or external refresh control logic. Data access time is 300ns and cycle time is 525ns. Power consumption is under 7 watts. Size is 8.44 by 5.187 inches. Prices: $390 for 8Kx16, $750 for 32Kx16. Chrislin Industries, Via Colinas #102, Westlake village, CA 91361, (213) 991-2254.

CIRCLE INQUIRY NO. 140

Floppy disk storage system, the Phrasestore, attaches directly to an IBM model 50, 60 or 75 electronic typewriter. The system includes two temporarily working storage memories with edit capabilities. Data may be permanently stored on minifloppy diskettes for later recall. One diskette holds up to 50 pages. No typewriter modifications necessary. When the power is shut off, the unit electronically isolates itself from the typewriter. In this mode, it functions as an ordinary typewriter. Edit features include add, delete, insert, merge and search commands. Price $1810. California Micro Computer, 9323 Warbler Ave., Fountain Valley, CA 92708, (714) 968-0890.



CIRCLE INQUIRY NO. 141

One-megabit magnetic bubble memory device, the 7110-1, specified for operation to 70 °C, extends the operable temperature of micros beyond the previous 50 °C maximum. (Integrated circuit range extends to 70 °C.) This also makes bubble use possible where disk and tape memories (10 °C-50 °C range) cannot function. The unit extends the temperature range of the module's storage and bootstrap loops and includes a lower-amplitude current pulse requirement for writing. It is available individually or as part of the BPK71 prototype kit. Price: unit $1985, kit $2280. Intel Magnetics, 3000 Oakmead Village Dr., Santa Clara, CA 95051, (408) 987-6046.

CIRCLE INQUIRY NO. 142

Small business computer, 8000 series, features an 80 character wide display screen for faster and easier text editing and report formatting. The series is available in 16K (model 8016) and 32K (model 8032) and can operate using Basic in both interactive and program modes with expanded commands and functions for arithmetic, editing, and disk file management. Display screen generates 64 Ascii characters and 64 graphic characters which are formed within an 8x8 dot matrix. A 73-key typewriter-like keyboard and a numeric keypad offers a repeat key capability. Price: 8016, $1495; 8032, $1795. Commodore Business Machines, 3330 Scott Blvd., Santa Clara, CA 95050.

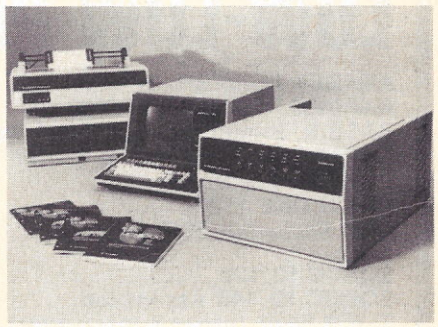


CIRCLE INQUIRY NO. 143

High-performance microcomputer board based on the Z8001 microprocessor is designed for uses requiring extensive computer power, access to a large memory space and high-speed serial communication capability. The Z8000 MPU can function as a stand-alone single-board microcomputer or as the master in a set of several peripheral boards. It comes with 32K of on-board RAM with parity protection, 8K of additional ROM or PROM space, two flexible communication channels and a real-time clock. Other features include parity-error detection circuit, three types of interrupts and three LED displays. Price $2295. Zilog, 10460 Bubb Rd., Cupertino, CA 95014, (408) 466-4666.

CIRCLE INQUIRY NO. 144

Micro development system using the MC68000 microprocessor not only supports the 16-bit capability of the MC68000, but anticipates the requirements of the next generation 32-bit machines. The Exormacs system has a chassis replete with a basic complement of functional modules, an intelligent CRT terminal, a 132-column printer and a 1-megabyte dual-drive floppy disk mechanism. An advanced operating system, symbolic debug assembler/editor and Pascal compiler make up the software. The basic chassis houses a switching power supply, cooling fans and front-panel controls. An internal card cage accommodates up to 15 modules, four of which are included in the basic system. Price $28,775. Motorola Semiconductor Products, P.O. Box 20912, Phoenix, AZ 85036.



CIRCLE INQUIRY NO. 145

Generalized subroutine facilities for the TRS-80 II includes the following functions available through USR calls from Basic: multi-key multivariable in-memory sort, multi-key character string in-memory sort, USR peek and poke capability (both byte and word), compress and uncompress data, move blocks of data, propogate across arrays. Sorts are fast and flexible: 1000 elements in six seconds, 5000 elements in 26 seconds. Carries up to 15 arrays together with multiple mixed ascending/descending keys. Racet Computes, 702 Palmdale, Orange, CA 92665.

CIRCLE INQUIRY NO. 146

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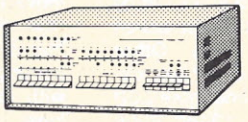
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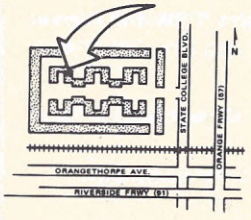
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CIRCLE INQUIRY NO. 72

CALENDAR

Aug 5-7 Data Eighty, Centrepoint, Sydney N.S.W. Australia, exhibition of computers, business communication systems and information handling equipment, including minis, micros, mainframes, peripherals, hardware and software. Data 80, P.O. Box 781, Darlinghurst NSW 2010, Australia, (02) 212 4199.

Aug 21-24 Fifth Annual Personal Computing and Small Business Computer Show (PCC '80), Convention Center, Philadelphia, PA, exhibits and seminars highlighting all aspects of personal and small business computing. John Dilks, Rt. 1, Box 242, Mays Landing, NJ 08330, (609) 653-1188.

Sep 3-5 Electronic Business Communications Conference and Exposition, Convention Center, Las Vegas, NV, has been postponed. New dates are Sep 9-11, 1981 at the same location. John Sodolski, Electronic Industries Assoc., 2001 Eye St. NW, Washington, DC 20006, (202) 457-4934.

Sep 4-6 Personal Computer World Show, Cunard Hotel, Hammersmith, London, computers, peripherals, supplies, software, supporting services, communications, publications for business, home and educational applications. Timothy Collins, 11 Manchester Square, London WIE 20Z, 01-486 1951.

Sep 11-13 Internepcon/Semiconductor International Conference and Exposition, PSA World Trade Center, Republic of Singapore, production machinery, tools, hardware, materials and test instruments keyed to needs of engineering, manufacturing and support personnel of Southeast Asia. Industrial and Scientific Conference Management, 222 W. Adams St., Chicago, IL 60606, (312) 263-4866.

Sep 16-18 Wescon/80, Convention Center, Anaheim, CA, High-technology electronics convention and exhibition with approximately 1200 booths. Robert Myers, 999 N. Sepulveda Blvd., El Segundo, CA 90245, (213) 475-4571.

Sep 19-21 The Decade of Opportunity Home Electronics Show, Brooks Hall, San Francisco, CA, hands-on demos of home electronic products, VTRs, TV games, TVs, radio cassettes, calculators, home computes. Ginger Taylor, J & J Concepts, 5120 Campbell Ave., Suite 208, San Jose, CA 95130, (408) 866-1494.

Sep 22-25 Twelfth Annual Conference of the Society for Management Information Systems, Fairmont Hotel, Philadelphia, PA, examining the need for management information executives to incorporate data processing, word processing, office automation, image processing, telecommunications, SMIS, 111 E. Wacker Dr., Chicago, IL 60601.

Sep 22-25 National Software Package Conference and Exposition, Hyatt Regency, Chicago, IL, recent innovations in systems houses, data processing, telecommunications and word processing. Kim Moloney, Software Info, Professional Exposition Management Co., Suite 545, 222 W. Adams St., Chicago, IL 60606, (312) 263-3131.

Sep 25-26 Ada Introduction and Trends Seminar, Sheraton Motor Inn, Lexington, MA, application examples, lectures, informal sessions on the Ada language as it applies to industry. Prof. Donald French, Institute for Advanced Professional Studies, One Gateway Ctr., Newton, MA 02158, (617) 964-1412.

BOOK REVIEWS

BASIC FOR HOME COMPUTERS—A Self-Teaching Guide

ATARI BASIC—A Self-Teaching Guide

By Bob Albrecht, LeRoy Finkel, and Jerald Brown
John Wiley & Sons, New York, NY

Reviewed by Roger H. Edelson

The era of cloning is here—in books at least. These books are virtually identical twins, although the Atari Basic presents material specific to Atari 400 and 800. I don't suggest that this approach is wrong, but the prospective buyer should know that the books present identical material and those with Atari machines need not buy the other book.

The books are designed as self-teaching guides with questions and answers. With this format, the authors feel it isn't necessary to have a computer to learn Basic.

Both books are intended to turn a rank beginner into a reasonable facsimile of a Basic programmer. I suspect they will; after a couple of days my 14 year old daughter was writing programs with 'if-then' statements and 'for-next' loops.

The books don't cover more advanced topics than subroutines; for example, 'tab' is only mentioned briefly and 'print using' doesn't exist. The Atari book barely mentions subroutines, substituting a chapter devoted to color and sound. Information covering structured, or top-down, programming techniques might have been included.

One error in the Atari book is the statement that "K" stands for "thousands of bytes," when capital K actually represents a binary thousand (1024). The interchanging of k and K is confusing to beginners and it is a disservice to continue promulgating it. □

Basic, 336 pages, $6.95 *Atari, 329 pages, $5.95*

THE A TO Z BOOK OF COMPUTER GAMES

by Thomas C. McIntire
Tab Books, Blue Ridge Summit, PA

Reviewed by Dennis Doonan

Looking for a collection of computer games in Basic, or an interesting way to learn programming? This book is sure to be of interest. It contains 26 games, one for each letter of the alphabet, ranging from the simple to the complex. The classics NIM, wumpus, blackjack, poker and battleship are here, along with dice and artillery practice.

The internal structure of each game is simple, composed of individual blocks doing assigned tasks. These stand-alone modules are tied together by the main program. There are few 'rem' statements used, but each chapter has a long description of the game, the logic behind it, diagrams, flowcharts, and reasons why it was set up that particular way. For the student, this is an ideal way to study program design. At the same time, each game can simply be entered and played. Output formatting is kept simple with short print lines. Almost any Basic can be used since each game takes less than 4K of memory. A section is also included to help translate to your dialect of Basic.

This is a handy book for both the programming beginner and the games player. □

308 pages, $12.95



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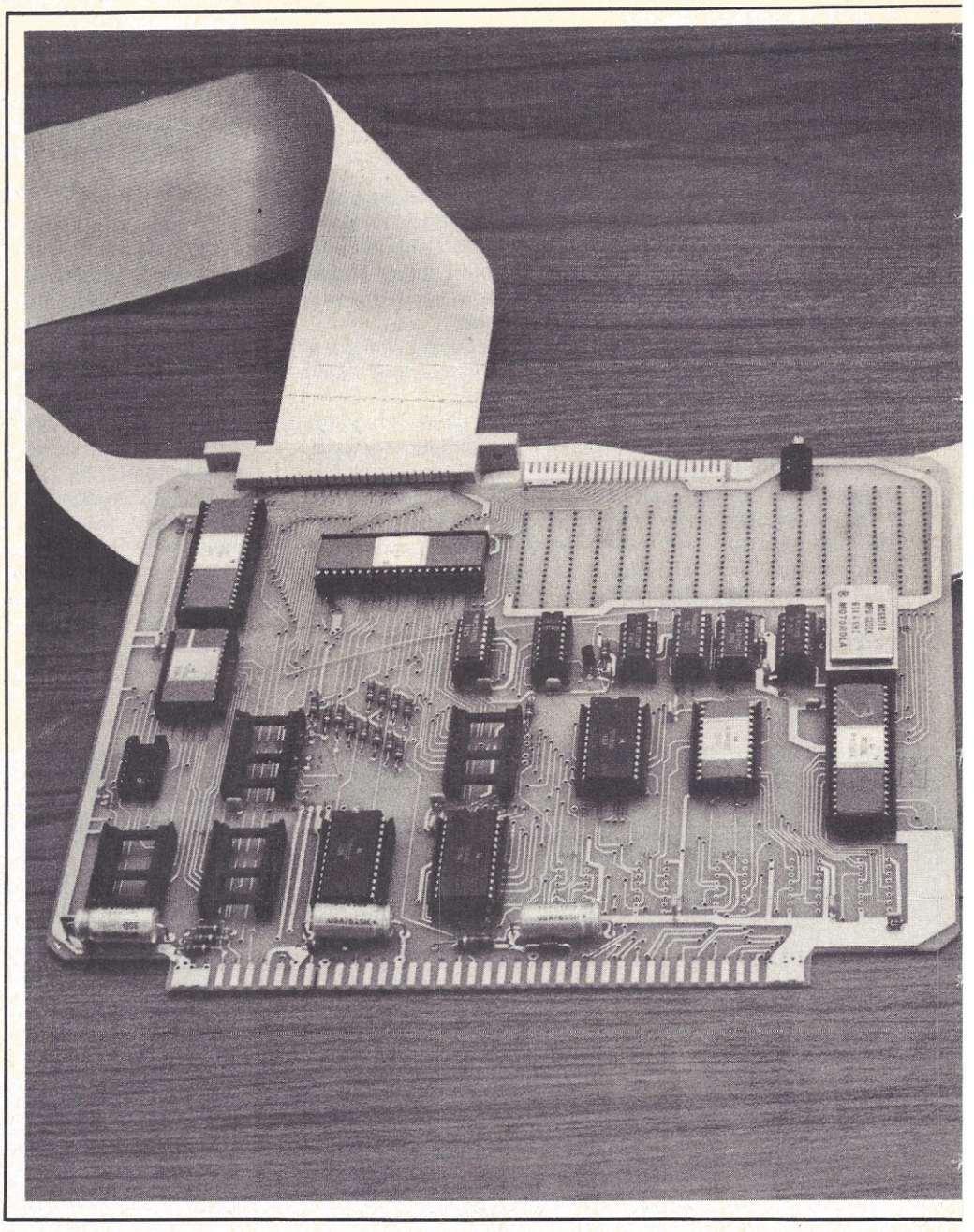
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CIRCLE INQUIRY NO. 81

Motorola's MEK 6800



by Stanley F. Lundgren

When I decided to become familiar with microprocessors, I wanted a system that would give me experience with both hardware and software. The Motorola MEK 6800 D2 evaluation kit is such a system.

My decision to purchase the kit was mainly economic. I did not make a study of the hardware, software or bus structures. I found that for less than $300 I could have a microprocessor-driven computer system.

My interest was a system with both machine level and high level language capabilities. This system met the requirement.

The kit is an excellent tool for those who wish to develop systems with the 6800 microprocessor. All the parts needed are supplied, except the power supply. The kit is readily expandable into a more complex system by adding memory, firmware and peripherals.

The kit is reasonable in price, selling in single quantities for about $250. After a few hours of assembly time and connecting a suitable 5v DC source, machine language programs can be entered through the kit's hexadecimal keyboard or the built-in audio cassette interface.

D2 Evaluation Kit

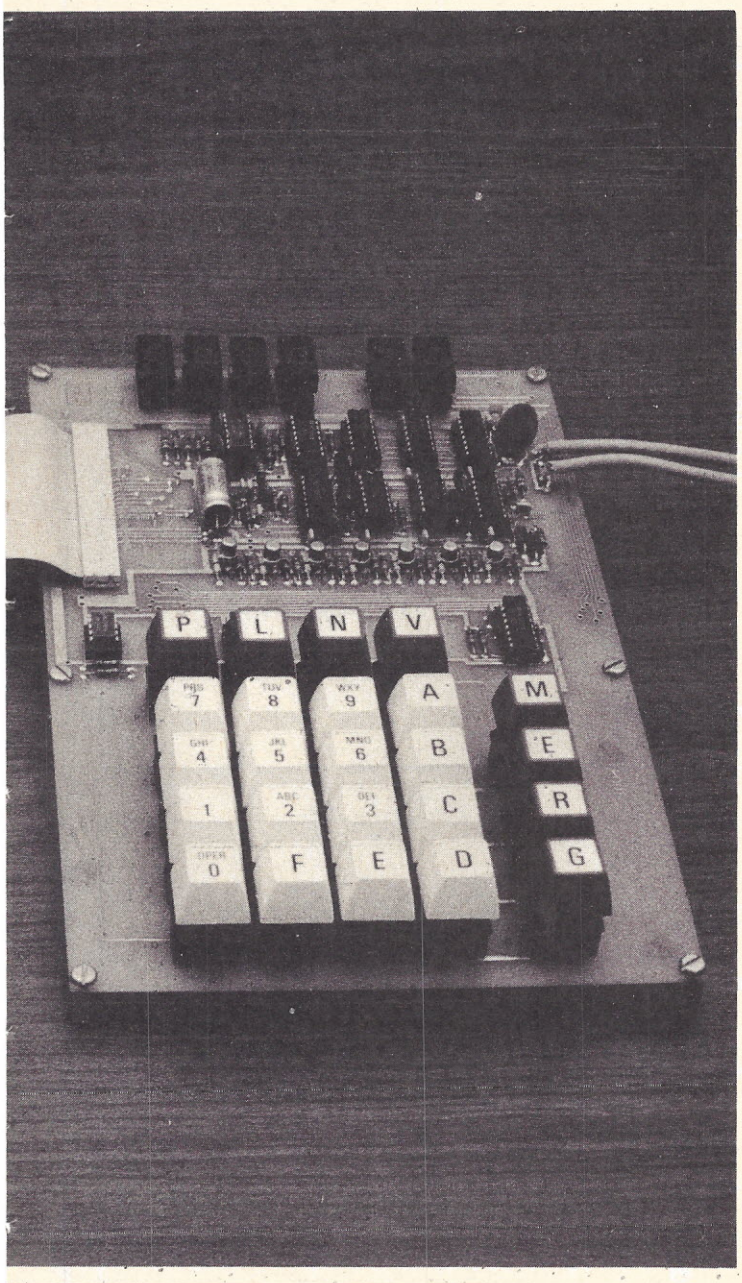


Photo 1. Assembled Motorola MEK 6800 D2 Kit *(Photo courtesy of Motorola)*

Power Supply

This is the heart of the system. Also, in order to interface the D2 to peripherals, you must have an RS-232C interface. Therefore, any well-designed microprocessor power supply must provide the ± 12v DC required by the RS-232 interface. My present ± VDC requirements are:

Description	I.C. No.	+ 12v mA	– 12v mA
Data Out Interface	1488	25	15
Data In Interface	1489		26
Onboard Eprom	2708	100	
Onboard Eprom	2708	100	

Another device requiring the + 12v DC is the 2708 Eprom. In planning the power supply, allow at least an additional 200 mA for the two 2708s the D2 has provisions for.

In addition to the above requirements, there are heavy demands put on the power supply by the main memory. The standard semiconductor memory devices such as the 21L02 are rather power-hungry devices. A 21L02 can consume up to 35 mA. One 21L02 is equivalent to 128 bytes. Therefore, each 8K memory board should be allowed:

$$64 \times 35\ mA = 2.24\ Amps$$

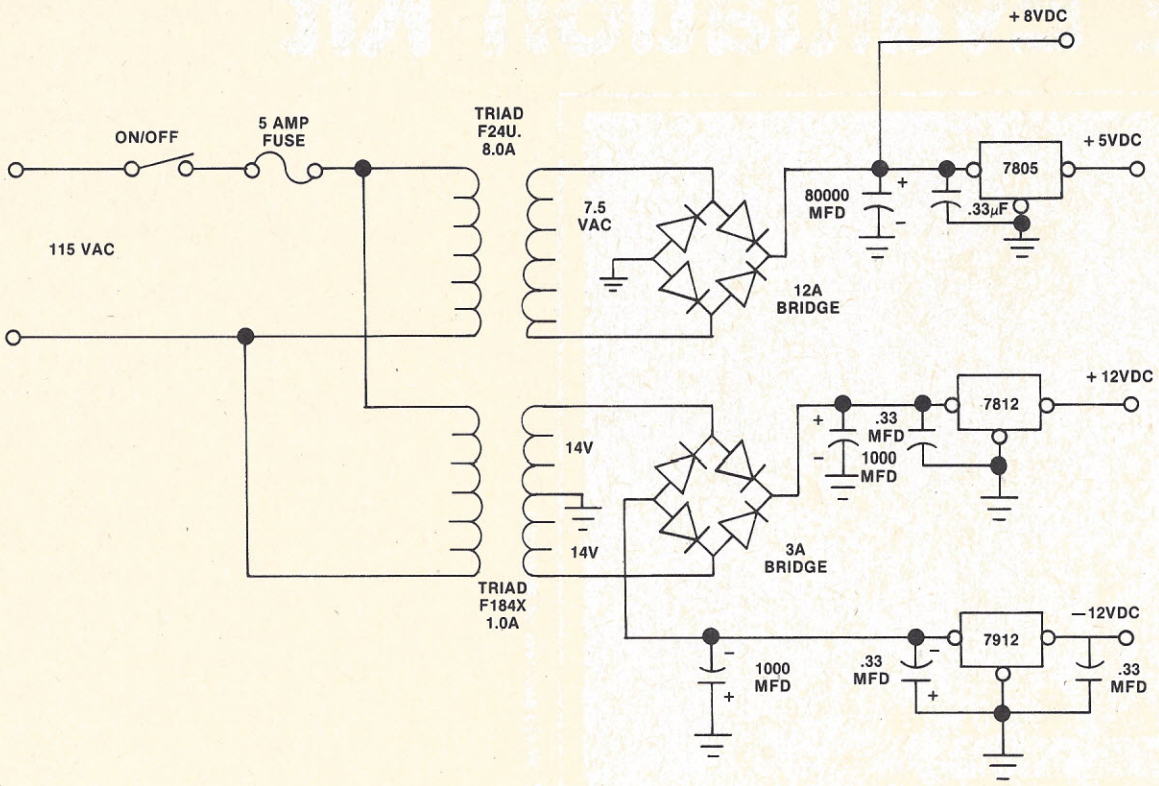


Figure 1. Power Supply

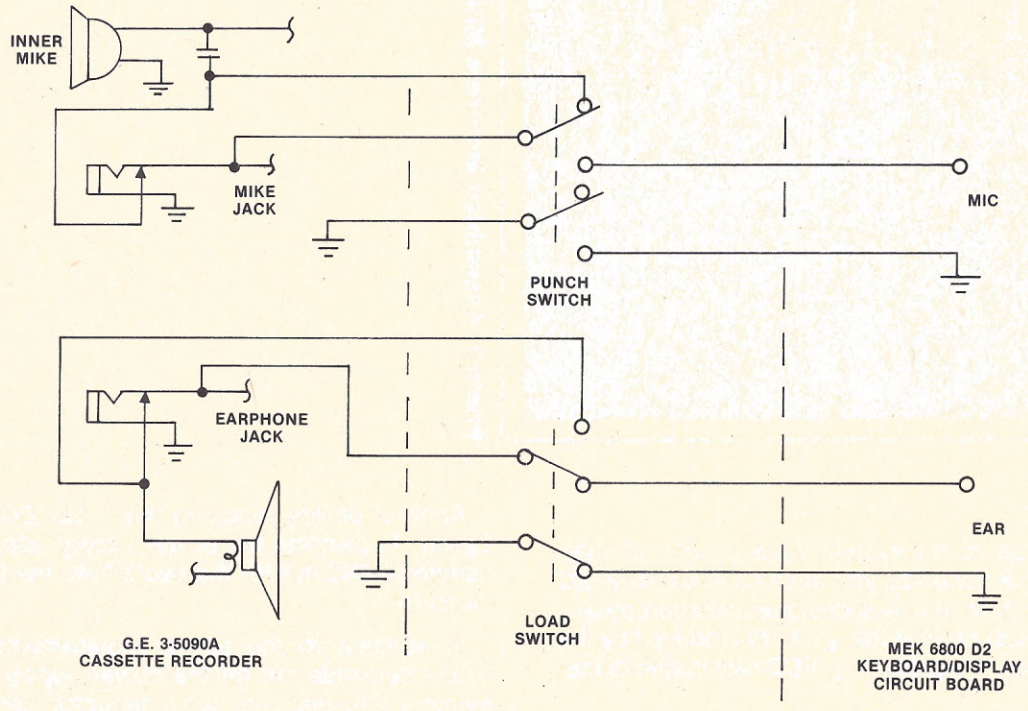


Figure 2. Switches allowing permanent cassette recorder connections.

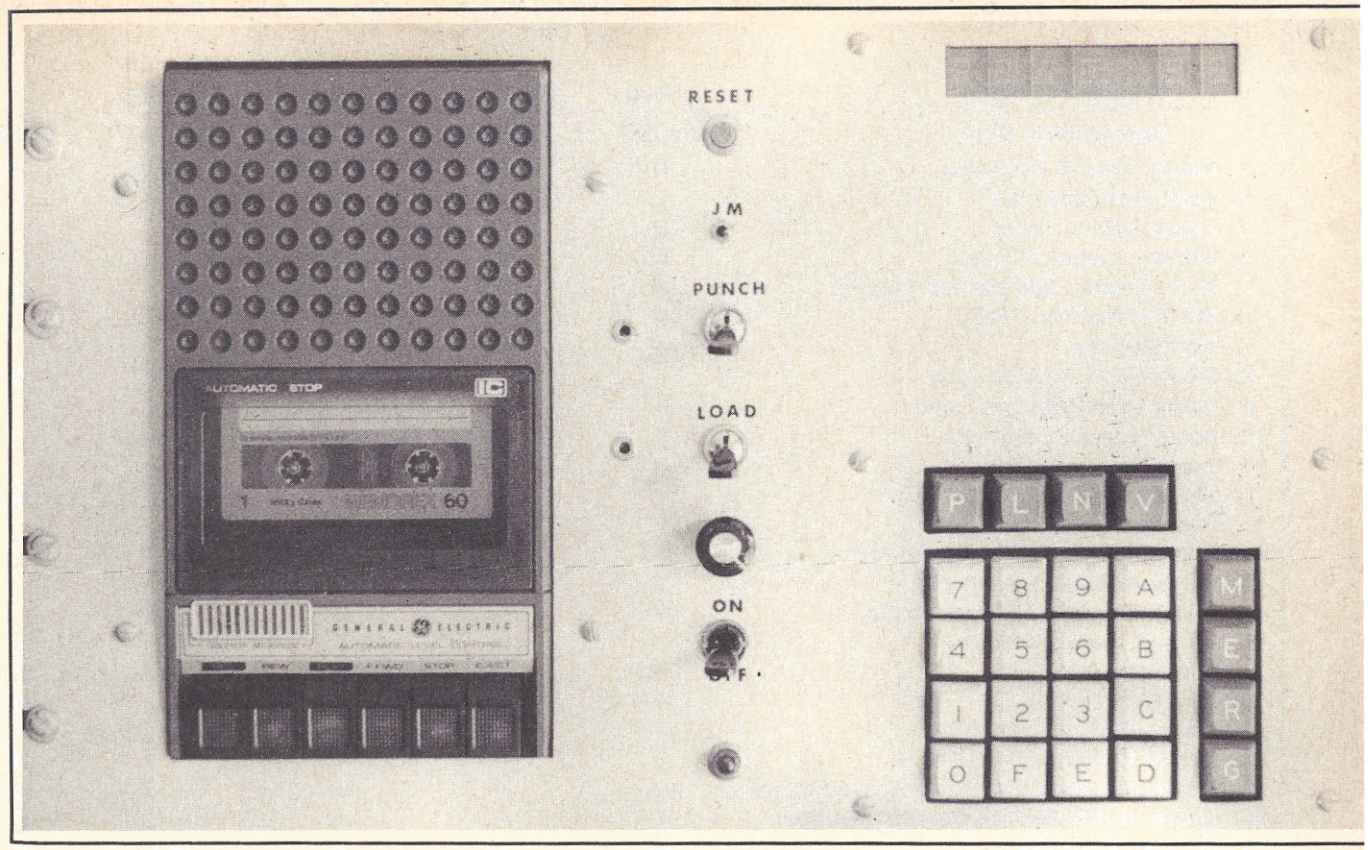


Photo 2 Front panel with D2 keyboard/display module and cassette recorder mounted. *(Photo by Don Cluck)*

I would recommend the following minimum D2 power supply requirements:

Description	Amps
+5v DC	
MEK 6800 D2 Kit	1.5
24K bytes of memory	6.6
+12v DC	
RS-232C Interface	.03
2708 Eproms	.20
−12v DC	
RS-232C Interface	.05

Physical distances between some components on the power supply are critical. This becomes increasingly important as more and more current is drawn. An easily overlooked area is the ground circuit. Do not let your large filter capacitor negative connection get very far from the supply ground. A few inches can be significant. If you have a problem here it will show up at the regulator outputs. The outputs will fall below 5 volts 120 times per second.

Case and Front Panel

These represent important considerations in building a computer system. The case must satisfy the housing requirement. The front panel must provide the interface between man and machine.

Motorola has done a nice job in providing a hexadecimal keyboard for input as part of the D2 kit. The hexadecimal keyboard provides a much faster means of inputting data and system commands than customary toggle switches.

I mounted my keyboard and display circuit board on an aluminum front panel (photo 2) available at most large electronic supply stores. The size I used is 10½ by 19 inches.

On the left side I cut an opening for my tape recorder. To cut the hole I used a metal cutting blade and my hand held jig saw. The tape recorder is a General Electric model 3-5090A, used because it was the only recorder that would fit within the 10½-inch front panel dimension.

To get around the problem of no counter I use a verbal heading at the start of each record and a one-minute interrecord gap between each record on the tape. The verbal headings I use consist of:

1. Title
2. Brief description
3. Memory address references
4. Date recorded
5. Special instructions

Verbal Heading	Record No. 1	1-Minute Inter-record Gap	Verbal Heading	Record No. 2

In addition to the tape recorder, I added two switches for isolation (figure 2). These switches allow me to leave the (ear) and (mic) lines permanently connected to both the recorder and the D2. Three additional switches on the front panel are a reset pushbutton, an on/off power switch, and a monitor select switch.

I removed the reset pushbutton from the MPU board. I then mounted a heavy-duty pushbutton on the front panel. The on/off switch, a single pole double throw, controls the AC line to the power supply. The monitor select switch allows switching between the J-bug and Minibug II monitors. When making off-board connections, it is a good idea to use connectors. I used molex connectors which simplify future modifications and repairs.

Expansion

Motorola D2 kit expansion involves an alternate monitor, a card rack and a terminal. This expansion will

Table 1. Monitor Comparison

Monitor Function	J Bug	MiniBug II	MiniBug III	SmartBug	
Approximate Cost	**(In Kit)**	**$50.00**	**$75.00**	**$20.00**	**$39.95**
1. Display Internal Registers	R	R	R	R	R
2. Load RAM from Tape	L	L	L	L	L
3. Punch RAM to Tape	P	P	P	P	P
4. Memory Examine/Change	M	M	M	M	M
5. Go to Entered Address and Execute	G	G	G	G	G
6. Set Terminal Baud Rate	—	S	S	—	
7. Test Memory	—	W	—	—	
8. Binary Punch RAM to Tape	—	Y	—	—	D
9. Binary Load RAM from Tape	—	Z	—	—	
10. Abort Program Execution	E	—	—	—	
11. Trace One Instruction	N	—	N	—	
12. Set a Break Point	V	—	V	—	K
13. Reset a Break Point	V	—	U	—	
14. Continue Execute from Break Point	E,G	—	C	—	
15. Delete All Break Points	V	—	D	—	
16. Print Address of All Break Points	—	—	B	—	
17. Trace N Instructions	—	—	T	—	T
18. Turn Echo On	—	—	—	—	E
19. Turn Echo Off	—	—	—	—	N
20. Display Contents of 'A' Reg	—	—	—	—	A
21. Display Contents of 'B' Reg	—	—	—	—	B
22. Display Contents of Condition Code Register	—	—	—	—	C
23. Jumps to BFD-68 Disk Operating System	—	—	—	—	D
24. Sets Hardcopy Flag	—	—	—	—	H
25. Insert a Byte into Range of Memory	—	—	—	—	I
26. Jump to Program After 'J'	—	—	—	—	J
27. Quick Start Boots in BFD-68 Operating Sys.	—	—	—	—	Q
28. Displays Contents of Index Register	—	—	—	—	X
29. Jumps to E 400 User Defined Monitor Commands	—	—	—	—	4

convert the D2 kit into a computer system. As a guide for the system expansion, I followed Motorola's application note AN-771, *MEK 6800 D2 Microcomputer Kit System Expansion Techniques.*

This document is a must for all D2 users. It is an excellent approach to expanding the MEK 6800 D2 kit. The application note covers 8K and 16K memory interfacing. In addition to the memory interface, the paper covers a data terminal interface using a monitor that co-resides with the J-bug monitor supplied with the kit.

The J-bug monitor provides control over the hexadecimal keyboard, 7-segment displays, and the cassette interface. In order for the system to be connected to an Ascii terminal, an additional monitor is required. Monitor options are Mikbug, Minibug II, Minibug III and the Smartbug ROMs. I used the Minibug II monitor in my system.

At the time I decided to go with the Minibug II monitor, Smartbug did not exist. Secondly, I was under the impression an ACIA interface would improve the system's data transfer rate. Actually this has only a small influence on the transfer rate. This interface transfers data slightly faster from the data bus to the terminal. Data moving at 300 baud through an ACIA is moving at approximately the same speed as data moving at 300 baud through a PIA. With the ACIA there are slightly faster throughput times, but nothing that is very significant. The serial and parallel port routines to move one Ascii character are:

Minibug OUTCH = 30 clock cycles
Mikbug OUTEEE = 130 clock cycles

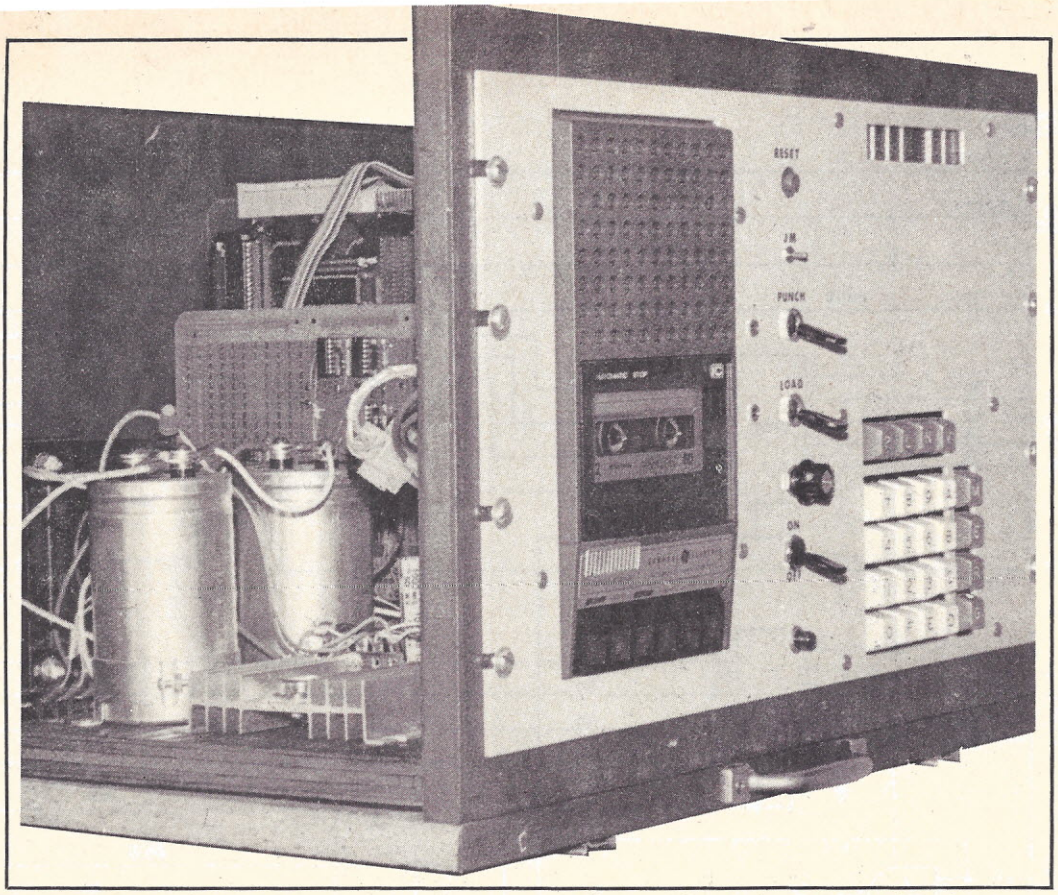
Based on a one megacycle clock, you would only add $^{1}/_{10,000}$ of a second per character transfer using a PIA and the Mikbug firmware.

Most of the 6800 software was written to use with the Mikbug monitor and a PIA interface. If one chooses to go with any other monitor, all of this software has to be modified, patched to make it work. Patching source code listings is time consuming but not difficult. However, trying to patch a Basic interpreter without the source listing is a mind boggler.

I would suggest for anyone using a monitor other than Mikbug to get the disassembler up and running first.

Table 2. Common MikBug and MiniBug II Patches

	MikBug		MiniBug III	
Description	**Label**	**Address**	**Label**	**Address**
Output 2 Hex Char	OUT2H	E0BF	OUT2H	E173
Output 4 Hex Char	OUT4HS	E0C8	OUT4HS	E17C
Output ASCII Char	OUTEEE	E1D1	OUTCH	E108
Input ASCII Char	INEEE	E1AC	INCH	E11F
Output ASCII String	PDATA1	E07E	PDATA1	E130
Output Left Hex	OUTHL	E067	OUTHL	E0FA
Output Right Hex	OUTHR	E06B	OUTHR	E0FE
Output Space	OUTS	E0CC	OUTS	E180
Monitor Control	CONTROL	E0E3	CONTRL	E040



(Photo by Don Cluck)

Photo 3 Microprocessor system pulled out, illustrating advantage of rack mount.

Card Rack

This is required to connect all the components of the system. It provides the common tie to all of the system circuit boards. There are no commercially available card racks that combine both the Exorcisor and S-100 bus.

It is a distinct advantage to be able to use S-100 boards in your system. For example, you can purchase 8K static RAM memory boards for about $130, compared to Motorola's 16K board for $395. The saving is obvious, and for the cost of a couple of ICs you can construct an S-100 interface.

To construct my card rack I used wire wrap connectors and mounted them on 1/16-inch thick masonite. I am using two Exorcisor connectors and three S-100 connectors. The two Exorcisor connectors are used for the MPU board and an expansion board. The three S-100 connectors house three 8K memory boards.

I used small screws and solder lugs to provide for the power connections, soldering the wire wrap wire from the bus to the solder lugs. Then the power supply lines were connected to the small screws using wire terminals. The peripheral ports use 25-pin RS-232 connectors and I mounted them on the expansion circuit board.

The S-100 Interface

There are two reasons why a hardware interface is required between the two buses. First, there is a slight difference in the control signals. The Exorcisor bus control signals are R/W, 02 and VMA, while the S-100 signals are MWRITE and SMEMR. Secondly, the S-100 bus is uni-directional. Data flows only one direction on each data line. This means there are two data lines for each data bit. Of course, the Exorcisor is bi-directional and uses only one line for each data bit.

I constructed my interface (figures 3 and 4) from a concept provided by Jade Electronics. I made only one slight modification, adding a buffer to the VMA signal.

The S-100 bus requires an 8v DC unregulated supply to drive the on-board 5-volt regulators. Don't be too generous with this voltage. I have seen specifications ranging from 8-11v DC. At one time I tried to use 9 volts. This worked the 7805s too hard, forcing them to run hot. My present supply delivers just over 7½ volts. This keeps everything nice and cool.

Terminal Selection

I am using Southwest Technical Products' CTC-64. This system comes complete with a 9-inch Motorola monitor. The kit is easy to assemble and it comes with all the documentation necessary. An excellent feature of this kit is the provision for programming. Using appropriate jumpers during assembly you can control with software such features as paging, scrolling, control key assignments, cursor control, bell control and highlighting.

The highlighting function is desirable, but not that easy to use. Highlighting is when the character and background are reversed. SWTP uses the 7 bit to control the highlighting function. The CTC-64 by itself highlights fine.

However, when combined with the Minibug II monitor, the 7 bit is lost during the input algorithm. This is because this algorithm ANDs the incoming data byte with a 7F, dropping the seventh bit. It is still possible to generate highlighted characters. It requires you to generate your own special character set with the 7 bit high. □

Figures 3 and 4 follow

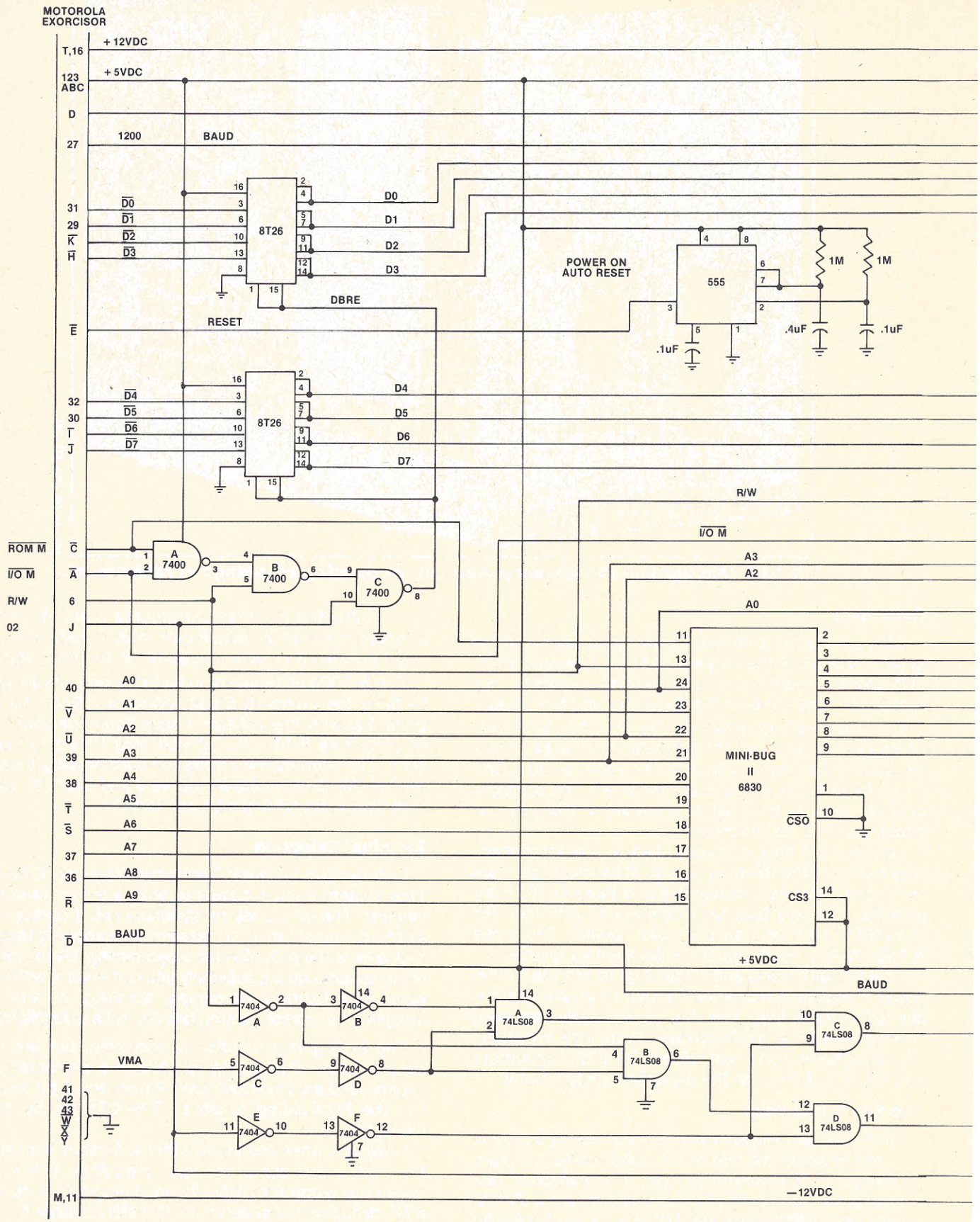
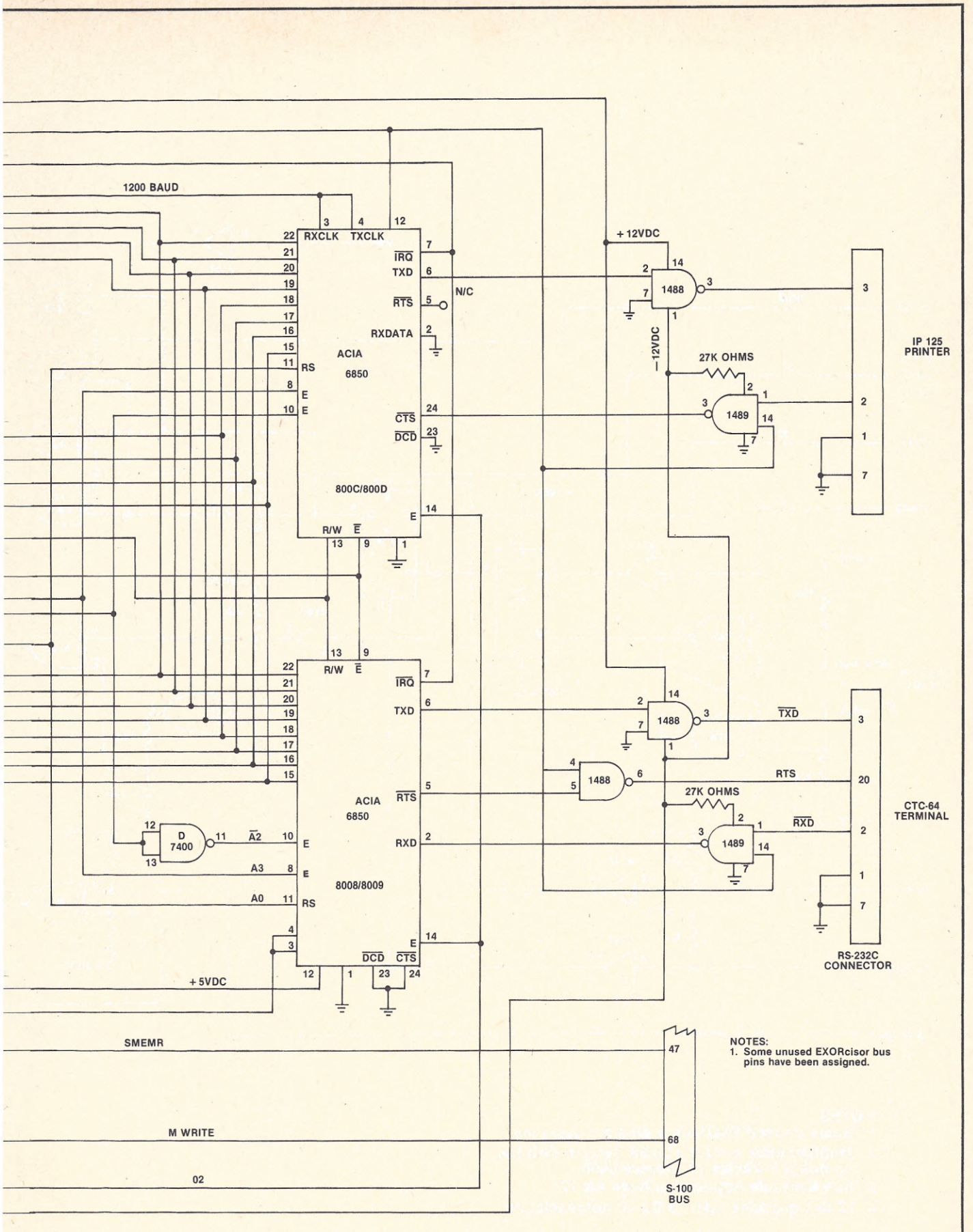
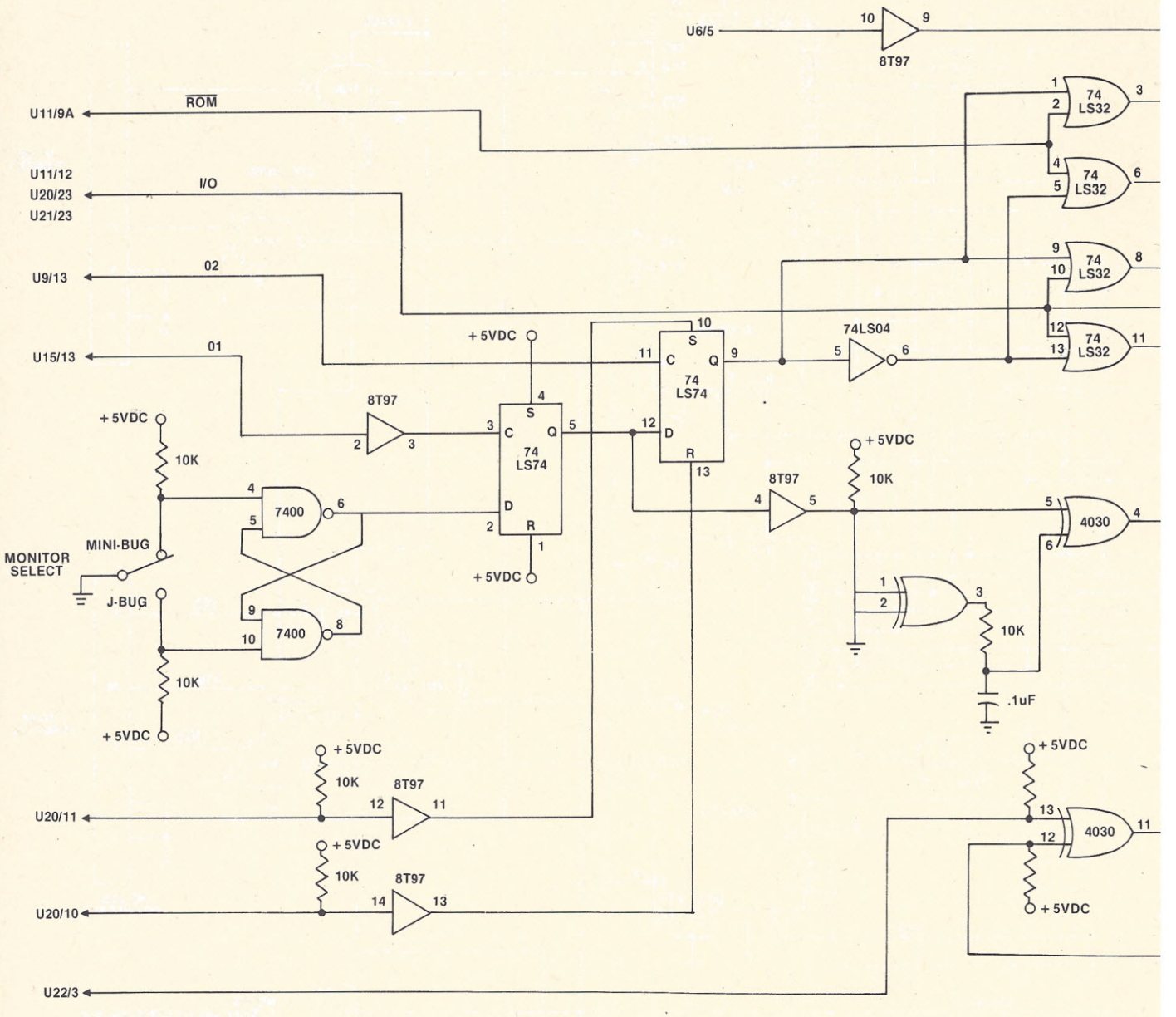


Figure 3. Expansion Board



NOTES:
1. Some unused EXORcisor bus pins have been assigned.

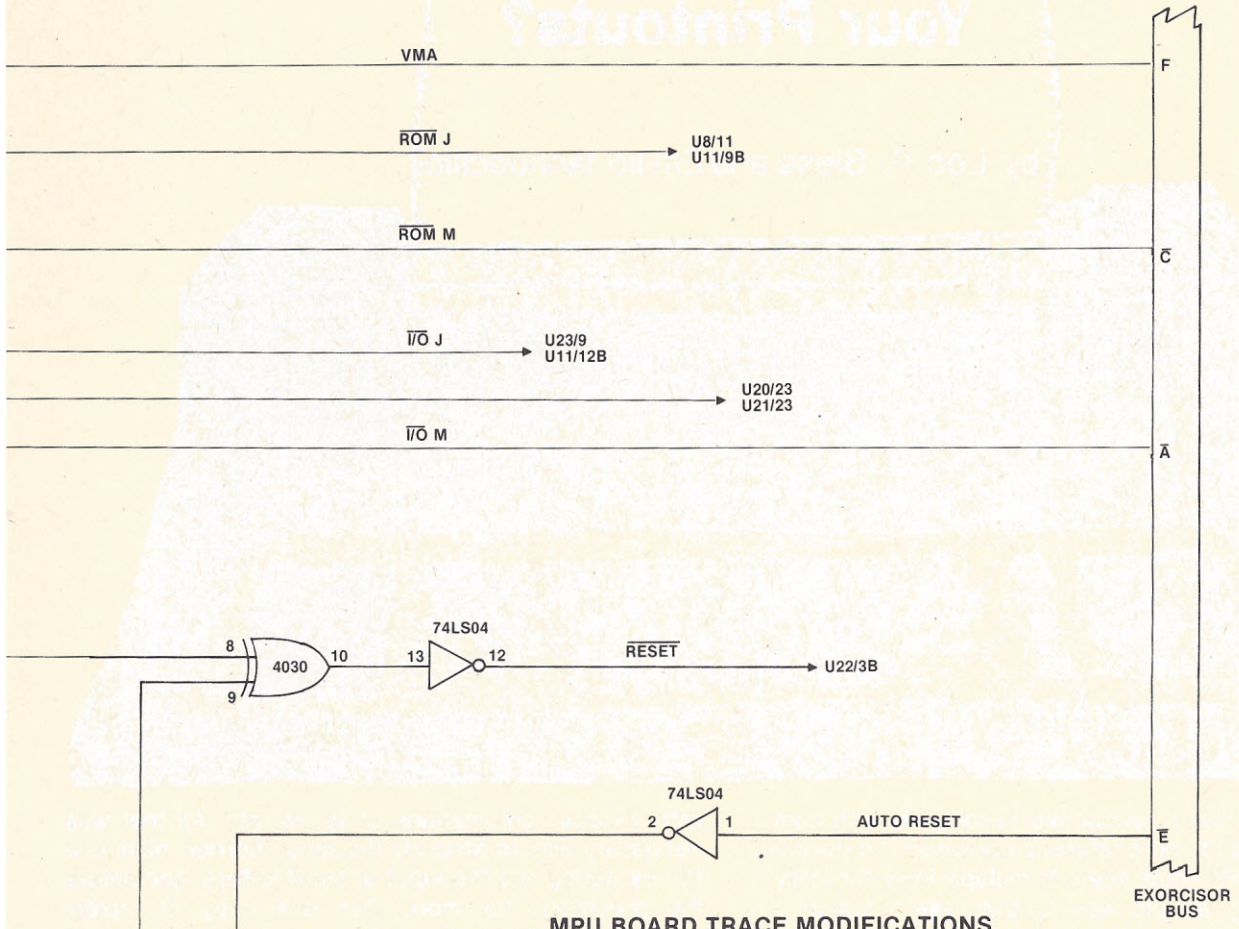
(Peripheral I/O and MINIBUG II).



NOTES:

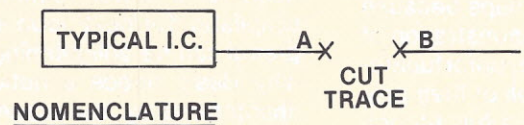
1. Some unused EXORcisor pins are assigned.
2. Modifications are for a 24.5K system with the on board 512bytes at address 6000_{16}.
3. See Motorola Application Note AN-771.
4. IC designations refer to D2 kit nomenclature.

Figure 4. Wire Wrap Area MPU Board



MPU BOARD TRACE MODIFICATIONS

CUT TRACE AT	COMMENTS	TERM
U11/9	See Schematic	$\overline{\text{ROM}}$
U11 12	See Schematic	$\overline{\text{I/O}}$
U22/3,4	See Schematic	$\overline{\text{RESET}}$
U20/23	'A' Side to U11/12	I/O USER PIA
U21/23	'A' Side to U11/12	I/O KEYBOARD PIA
U11/4	'A' SIDE N/C	$\overline{\text{RAM}}$
U11 7	'A' SIDE TO U11 4B 'B' SIDE N/C	$\overline{\text{PROM}}$ 1 6000_{16}



NOMENCLATURE

UXX/N

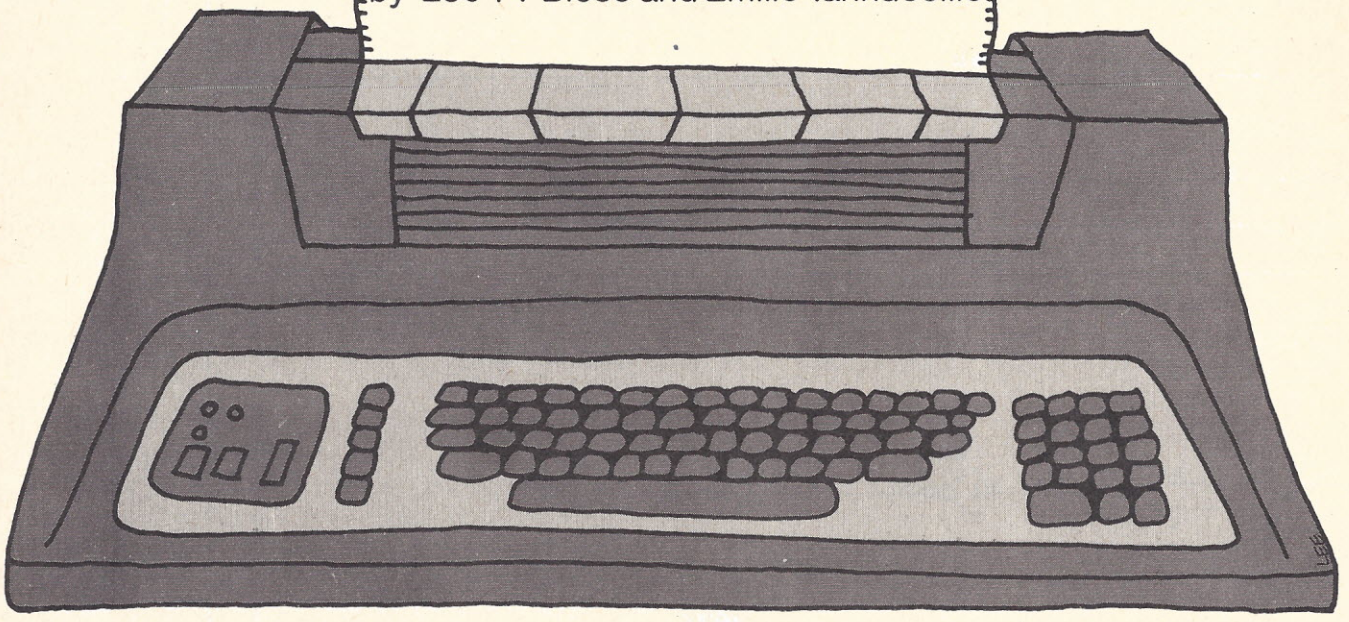
- PIN NUMBER
- I.C. NUMBER

(Dual Monitor Switching Logic w/Auto Reset)

MASTHEAD:

Why Not Title Your Printouts?

by Leo P. Biese and Emilio Iannuccillo



One of the minor headaches associated with computing is trying to find a reference program "in the pile somewhere." Printouts seem to multiply logarithmically. The first thing we did was to purchase a bunch of 3-ring notebooks in color codes (blue for database, green for system utilities, etc.) which helped—for about a month. The green ½-inch ring was replaced by a green 3-inch ring, and then needed a "supplement" green volume II. Nifty catalog index systems were instituted and fancy reference pages generated, but we still couldn't quickly find a printout of our mail list ver. 2, and distinguish it from the other four versions.

What was needed was a program to print legible titles at the top of a printer listing.

Programs of the Banner type have been with us since the first days of personal computing, perhaps because they offered a readily understandable demonstration of our computer power. None of them were, unfortunately, of much help. Dartmouth DTSS titles all of their programs, but does it in @ signs and needs a full 14-inch page; other programs print only vertically or require some obscure Basic with systems calls.

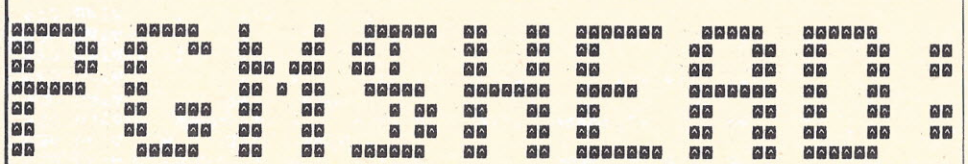
The A.R. Miller program Poster (IA Oct 79) was the first real help because it offered letters in a "usable" 7x7 matrix and the concept of overprinting the line both to approximate a block character and incidentally darkening the printing. We added a third overprinting of an O for our printers, but the user should experiment with various combinations of W, M, etc. All that was necessary was to strip off the fancy border, eliminate the centering and the input of small letters, and delete the provisions for more than one copy. It rapidly became one of our "most used" programs and is reproduced below as 'pgm$head.'

Unfortunately, we wanted to title assembly language printouts, data listings, and texts created with the system editor as well. It became a real chore to load 24K Basic just to print a heading and then go back to the operating system—especially if we goofed later on and had to do it all over. The answer was an 8080 assembly language version called Masthead.

Masthead is, as far as possible, a "direct" translation of the Basic program. The main difference is the need for a buffer routine to achieve that remarkably simplistic 'for/next' loop in Basic. A study of both programs can be enlightening and suggests, for example, why Basic needs a noticeable delay to read in the character array; the assembly version goes to work immediately because the character data is already there.

Both programs have been titled using the programs themselves and contain sufficient comments so that further details are not necessary. We use the CP/M system and file the assembled version as a memory image '.com' file on the disk under the name 'mh.com.' With the system, the program becomes a direct command and a heading title is produced simply by entering: MH (space)(title). □

PROGRAM LISTING



```
100 'PGM$HEAD: A PROGRAM TO PRINT A LARGE TITLE AT THE HEAD OF A
    PRINTER LISTING. THE DATA MATRIX IS FROM THE POSTER PROGRAM
    BY A.R.MILLER; INTERFACE AGE 10/79

110 'This program was written by L.P.Biese (10/79) and requires
    a printer terminal that can: 'carriage return' upon recipt
    of an ASCII 13 decimal (0A Hex) code without a LF


120 DEFINT I-N                  'define variables I-N as as integer
130 DIM AL$(7,59)               'dimention the character matrix
140 FOR J=1 TO 59               'and load it
150     FOR I=1 TO 7
160         READ AL$(I,J)
170         NEXT I,J

180 LINEINPUT"PROGRAM TITLE (8 CHARS): ";SI$

190 IF LEN(SI$)>8 THEN PRINT:PRINT"CP/M FILEMAMES ARE LIMITED";:
    PRINT" TO 8 CHARACTERS":PRINT:GOTO 180

200 SI$=SI$+":"                 'put a colon after the filename

210 FOR I=1 TO 7                'start one of 7 rows of spots
220     SP$="A":GOSUB 310       'print 'A' according to matrix
230     LPRINT CHR$(13);:SP$="W" 'backspace, change font to 'W'
240     GOSUB 310               '       and overprint the line
250     LPRINT CHR$(13);:SP$="O" 'backspace, change to 'O'
260     GOSUB 310               '       and do it a 3rd. time
270     LPRINT                  'advance the paper and
280     NEXT I                  'set the next row of spots

290 LPRINT:LPRINT               'kick up 2 lines
300     END                     'and quit

    ================ SUBROUTINE ============================

310 'Get the position of the char spots from data matrix AL$.

320 FOR L=1 TO LEN(SI$)         'for the length of the headins
330     LL=ASC(MID$(SI$,L,1))-31 'correct each letter's ASCII code
340     IF LL>64 THEN LL=LL-32  'convert lowercase
350     A2$=AL$(I,LL)           'A2$ = printable position
360     FOR M=1 TO 7            'check each spot for a blank

370         IF MID$(A2$,M,1)=" " THEN LPRINT " ";ELSE LPRINT SP$;

380         NEXT M              'set the next spot
390         LPRINT "  ";        'put in a space
400     NEXT L                  'and get the next letter
410     RETURN
420 '

430 '*************** CHARACTER DATA ****************************


440 DATA "       ","       ","       ","       ","       "
450 DATA "       ","       "
460 DATA "   !   ","   !   ","   !   ","   !   ","   !   "
470 DATA "       ","       "
480 DATA "       "," XX XX "," XX XX "," XX XX ","       "
490 DATA "       ","       "
500 DATA "  # #  "," # #  ","#######","  # #  ","#######"
510 DATA "  # #  "," # #  "
520 DATA " $$$$$$","$$ $   ","$$ $   ","$$$$$ ","   $ $$"
530 DATA "   $ $$","$$$$$$ "
540 DATA " %%%%%","%  %  % ","    %  ","   %   ","  %    "
550 DATA " %  %% ","%   %% "
560 DATA "  &    "," & &   ","   &   "," & &   ","&   & &"
570 DATA "&    & "," &&&& &"
580 DATA "       ","  ''   ","  ''   ","  '    ","       "
590 DATA "       ","       "
600 DATA "      ("," ( ","  (  ","  (  ","  (  "
610 DATA "     ( "," (","     "
620 DATA ")      "," )  ","  )  ","  )  ","  )  "
630 DATA " )     ","  )    "
640 DATA "*  *  *","* * * ","  ***  ","*******","  ***  "
650 DATA " * * * ","*  *  *"
660 DATA "   +   ","   +   ","   +   ","+++++++","   +   "
```

```
670 DATA "   +    "," +  "
680 DATA "        "," "," "," "
690 DATA "   ,    "," ,  "
700 DATA "        "," "," "," ---  "," "
710 DATA "        "," "
720 DATA "        "," "," "," "
730 DATA "  ..    "," ..  "
740 DATA "      /","    / ","   /  ","  /   "
750 DATA " /      ","/    "
760 DATA " 00000 ",0     0,0     0,0     0,0     0
770 DATA 0     0," 00000 "
780 DATA "   1    "," 11   "," 1 1   "," 1   "," 1   "
790 DATA "   1    "," 11111 "
800 DATA "  2222  "," 2   2","     2 "," 2   "," 2   "
810 DATA "  2     ","2222222"
820 DATA " 33333 ",3     3,"      3","    33 ","      3"
830 DATA "3     3"," 33333 "
840 DATA "    44 "," 4  4 "," 4   4 ","444444 ","     4 "
850 DATA "     4 "," 4 "
860 DATA "555555 ","5      ","5      ","55555  ","     5 "
870 DATA "     5 ","55555  "
880 DATA " 6666  ","6      ","6      ","66666  ","6    6 "
890 DATA "6    6 "," 6666  "
900 DATA 7777777,"     7 ","    7  ", "   7   "," 7    "
910 DATA " 7     ","77    "
920 DATA "  8888 "," 8    8"," 8    8","  8888 "," 8    8"
930 DATA " 8    8","  8888 "
940 DATA "  9999 "," 9    9"," 9    9","  99999","     9"
950 DATA "     9","  9999 "
960 DATA "       "," ::   "," ::   "," ::   "
970 DATA " ::    "," "
980 DATA "       "," ;;   "," ;;   "," "," ;  "
990 DATA "  ;    "," "
1000 DATA "    <  "," <   "," <   "," <    "," <   "
1010 DATA "   <   "," <   "
1020 DATA "       "," ===== "," ===== "," ===== "
1030 DATA " ===== "," "
1040 DATA "  >    "," >   "," >   "," >   "
1050 DATA "   >   "," >  "
1060 DATA "  ???  "," ?  ? "," ?  ? "," ?  "
1070 DATA "       "," ?  "
1080 DATA "       "," "," "," "
1090 DATA "       "," "
1100 DATA " AAAAA ",AA   AA,AA   AA,AAAAAAA
1110 DATA AA   AA,AA   AA,AA   AA
1120 DATA "BBBBBB ",BB   BB,BB   BB,"BBBBBB "
1130 DATA BB   BB,BB   BB,"BBBBBB "
1140 DATA" CCCCC ",CC   CC,"CC    ","CC    ","CC    "
1150 DATA CC   CC," CCCCC "
1160 DATA "DDDDDD ",DD   DD,DD   DD,DD   DD
1170 DATA DD   DD,DD   DD,"DDDDDD "
1180 DATA EEEEEEE,"EE    ","EE    ","EEEEE  ","EE    "
1190 DATA "EE    ",EEEEEEE
1200 DATA FFFFFFF,"FF    ","FF    ","FFFF   ","FF    "
1210 DATA "FF    ","FF    "
1220 DATA " GGGGG ",GG   GG,"GG    ","GG    ",GG  GGG
1230 DATA GG   GG," GGGGG "
1240 DATA HH   HH,HH   HH,HH   HH,HHHHHHH,HH   HH
1250 DATA HH   HH,HH   HH
1260 DATA "  IIII ","  II  ","  II  ","  II  ","  II  "
1270 DATA "   II  "," IIII "
1280 DATA "    JJ","    JJ","    JJ","    JJ","    JJ"
1290 DATA " JJ  JJ"," JJJJ "
```

```
        ORG     100H
        CALL    START
        DB 'Emilio''s Masthead Printer, Dec 1979'
        DB 0DH,0AH,'$'

START:  POP     D
        CALL    PRINTLINE
; Save old, set new stack
        LXI     H,0
        DAD     SP
        SHLD    ENTRY$STACK
        LXI     SP,STACK
; Check if anything set to be printed
        LXI     H,CPM$IN$BUF
        MOV     A,M
        ORA     A
        JZ      EXIT
; Check if count exceeds allowable input
        CPI     MAXCHR
        CNC     ERROR1
        INX     H
        INX     H
        SHLD    IN$BUF$POINTER  ;save last location
; Zero print buffer
        LXI     H,PRINT$BUF
        SHLD    PB$POINTER
        LXI     B,TOP$PB-PRINT$BUF
        INR     B
        XRA     A
ZERO    MOV     M,A
        INX     H
        DCR     C
        JNZ     ZERO
        DCR     B
        JNZ     ZERO
;-----------------------------------------------------------------
; MAIN ROUTINE
;-----------------------------------------------------------------

        CALL    LOAD$PRINT$BUF
        CALL    PRINT$MAST
        CALL    CRLF
        CALL    CRLF
        JMP     EXIT

ERROR1  LXI     D,TXT1
        CALL    PRINTLINE
        JMP     EXIT
TXT1    DB      'TOO LONG A PRINT LINE'
        DB      0DH,0AH,'$'

EXIT    LHLD    ENTRY$STACK
        SPHL
        RET

;-----------------------------------------------------------------
; SUB-ROUTINES
;-----------------------------------------------------------------

; Print line to the console

PRINT$LINE:
        PUSH    H
        PUSH    D
```

```
1300 DATA KK   KK,"KK  KK ","KK KK  ","KKKK   ","KKKKK  "
1310 DATA "KK  KK ",KK   KK
1320 DATA "LL     ","LL     ","LL     ","LL     ","LL     "
1330 DATA "LL     ",LLLLLLL
1340 DATA M     M,MM   MM,MMM MMM,MM M MM,MM   MM
1350 DATA MM   MM,MM   MM
1360 DATA N     NN,NN   NN,NNN  NN,NN N NN,NN  NNN
1370 DATA NN   NN,NN    N
1380 DATA " OOOOO ",OO   OO,OO   OO,OO   OO,OO   OO
1390 DATA OO   OO," OOOOO "
1400 DATA "PPPPPP ",PP   PP,PP   PP,"PPPPPP "
1410 DATA "PP     ","PP     ","PP     "
1420 DATA " QQQQQ ",QQ   QQ,QQ   QQ,QQ   QQ
1430 DATA QQ   QQ,QQ  QQQ," QQQQQQ"
1440 DATA "RRRRRR ",RR   RR,RR   RR,"RRRRRR ","RRRR   "
1450 DATA "RR RR  ","RR  RR "
1460 DATA " SSSSSS","SS     ","SS     "," SSSSS ","     SS"
1470 DATA "     SS","SSSSSS "
1480 DATA "TTTTTT ","  TT   ","  TT   ","  TT   ","  TT   "
1490 DATA "  TT   ","  TT   "
1500 DATA UU   UU,UU   UU,UU   UU,UU   UU,UU   UU
1510 DATA UU   UU," UUUUU "
1520 DATA V     V," V   V","  VV  VV","  V  V ","  VVVV "
1530 DATA "   VV  ","   VV  "
1540 DATA WW   WW,WW   WW,WW   WW,WW   WW,WW W WW
1550 DATA WWWWWWW," W  W  "
1560 DATA XX   XX," XX XX ","  XXX  ","  XXX  ","  XXX  "
1570 DATA " XX XX ",XX   XX
1580 DATA YY   YY," YY YY ","  YYY  ","   YY  ","   YY  "
1590 DATA "   YY  ","   YY  "
1600 DATA ZZZZZZZ,"     Z ","    Z  ","   Z   ","  Z    "
1610 DATA " Z     ",ZZZZZZZ
```

```
;  M A S T H E A D
;
; Emilio D. Iannuccillo; based on the Basic version by
; Leo. P. Biese
;
;
; HOW TO USE: Simply type  MH <space> <title desired> and the
;     title will be printed in bold characters on the printer
;     device. A  maximum of 8 characters fit on 8 1/2 " paper
;     and 14 on standard 14 " paper

;-----------------------------------------------------------
; INITALIZE:
;-----------------------------------------------------------
```

```
        PUSH    B
        PUSH    PSW
        MVI     C,CLCMD
        CALL    BDOS
        POP     PSW
        POP     B
        POP     D
        POP     H
        RET

; Load print buffer

LOAD$PRINT$BUF:
        LHLD    IN$BUF$POINTER  ;set next byte
        MOV     A,M             ;byte in A
        ORA     A
        RZ                      ;done when byte=0
        INX     H
        SHLD    IN$BUF$POINTER  ;save next location
        ANI     7FH             ;we want lower ascii group
        CPI     60H             ;is it lower case
        JC      $+5
        ANI     5FH             ;change to upper case
        SUI     20H             ;drop off non-print characters
        CALL    TIMES10         ;mult byte in A * 10
        LXI     H,CONVERT$TABLE ;point to beginning of table
        DAD     D               ;add offset from times10
        INX     H               ;add one
        CALL    FILL$PB         ;put print code in print buffer
        JMP     LOAD$PRINT$BUF  ;go back for another byte
;-----------------------------------------------------------
; Enter with subject byte in A
; Exit with 10 times subject byte in DE
;-----------------------------------------------------------

TIMES10:
        LXI     D,0
        MOV     E,A
        ADD     A
        MVI     C,3
        MOV     B,A             ;2 times stored in B (not over FF)
TLOOP   MOV     A,E             ;multiply times 8
        ADD     A
        MOV     E,A
        MOV     A,D
        ADC     D
        MOV     D,A
        DCR     C
        JNZ     TLOOP
        MOV     A,E             ;add 2 times to 8 times to get
        ADD     B               ;10 times
        MOV     E,A
        JNC     $+4
        INR     D
        RET

;-----------------------------------------------------------
; Enter with HL pointing to correct location in convert table
;-----------------------------------------------------------

FILL$PB:
        MVI     C,9             ;print buffer is 9 lines long
        XCHG                    ;for each letter to be printed
        LHLD    PB$POINTER      ;each byte represents the 7
```

```
FLOOP   LDAX    D               ;horizontal print positions
        MOV     M,A
        INX     H
        INX     D
        DCR     C
        JNZ     FLOOP
        SHLD    PB$POINTER
        RET

;---------------------------------------------------------------
; Print is done by going through the print buffer as follows:
; Start with first byte of print buffer. Check for bit 7 which
; indicates a print character is present. Then type a character
; horizontally for each of the remaining 7 bit position as
; indicated. Space 2. Then add 9 to the buffer table pointer
; to get the next character, if any. Continue until the  first
; horizontal line is complete. Then return carriage and repeat
; with two more print characters.
; Then add one to the print buffer pointer for the second line.
; Repeat the horizontal printing above again for the second line
; Then repeat the whole process again for 7 lines.
; Space up two and exit.
;---------------------------------------------------------------

PRINT$MAST:
        LXI     H,PRINT$BUF     ;Set PB pointer
        SHLD    PB$POINTER
        MVI     A,7             ;Print 7 horizontal lines to the matrix
        STA     PLOOP$COUNTER
PLOOP   LHLD    PB$POINTER
        PUSH    H
        MVI     A,CHR1
        STA     PTCHR
        CALL    RESET$PHEAD
        CALL    PRINTMATRIX
        MVI     A,CHR2
        STA     PTCHR
        POP     H
        PUSH    H
        CALL    RESET$PHEAD
        CALL    PRINTMATRIX
        MVI     A,CHR3
        STA     PTCHR
        POP     H
        PUSH    H
        CALL    RESET$PHEAD
        CALL    PRINTMATRIX
        POP     H
        INX     H
        SHLD    PB$POINTER
        CALL    CRLF
        LDA     PLOOP$COUNTER
        DCR     A
        STA     PLOOP$COUNTER
        JNZ     PLOOP
        RET

;---------------------------------------------------------------
; Enter with HL pointing at byte in printer buffer
; Exit when bit 7 = 0
; Else print out the character stored in PTCHR every
; time a bit is high. Space between letters. Jump
; nine in print buffer for next letter.
```

```
ENTRY$STACK     DW      0
                DS      128
STACK           EQU     $
IN$BUF$POINTER  DW      0
PRINT$BUF       EQU     $
                DS      200
TOP$PB          EQU     $
PB$POINTER      DW      0
PTCHR           DB      0
PLOOPCOUNTER    DB      0
;---------------------------------------------------------------
; CONVERSION TABLE FOR THE ASCII CHARACTERS
; to the hex code which signals the printer when to print
;
;FORM OF TABLE
;
;       | 00 | 01 | 02 | 03 | 04 | 05 | 06 | 07 | 08 | 09 |
;       ---------------------------------------------------
;       |    |  7 or 9 bytes of hex code
;       | A  |     one hex code for each print line
;       |    |       start with 7 by 7 matrix
;       | B  |         later we can use byte 8 & 9 for decenders
;       |    |
;       | C  |
;       |    |
;          ^-------here is the ascii code that we will use
;                  to test for a match. The print code follows
;                  in order
;---------------------------------------------------------------

CONVERT$TABLE:
        DB      ' ',80H,80H,80H,80H,80H,80H,80H,0,0
        DB      '!',88H,88H,88H,88H,88H,80H,88H,0,0
        DB      '"',182,182,182,80H,80H,80H,80H,0,0
        DB      '#',94H,94H,255,94H,255,94H,94H,0,0
        DB      '$',191,232,232,190,8BH,8BH,254,0,0
        DB      '%',177,178,84H,88H,90H,166,198,0,0
        DB      '&',90H,168,88H,168,197,194,189,0,0
        DB      27H,80H,98H,8CH,90H,80H,80H,80H,0,0
        DB      '(',81H,82H,84H,84H,84H,82H,81H,0,0
        DB      ')',192,160,90H,90H,90H,160,192,0,0
        DB      '*',201,170,9CH,255,9CH,170,201,0,0
        DB      '+',88H,88H,88H,255,88H,88H,88H,0,0
        DB      ',',80H,80H,80H,80H,80H,88H,90H,0,0
        DB      '-',80H,80H,80H,9CH,80H,80H,80H,0,0
        DB      '.',80H,80H,80H,80H,80H,98H,98H,0,0
        DB      '/',81H,82H,84H,88H,90H,160,192,0,0
        DB      '0',190,193,193,193,193,193,190,0,0
        DB      '1',88H,98H,168,88H,88H,88H,190,0,0
        DB      '2',9EH,161,82H,84H,88H,90H,255,0,0
        DB      '3',190,193,81H,86H,81H,193,190,0,0
        DB      '4',86H,92H,162,254,82H,82H,82H,0,0
        DB      '5',254,192,192,252,82H,82H,252,0,0
        DB      '6',188,192,192,252,194,194,188,0,0
        DB      '7',255,82H,84H,88H,90H,160,224,0,0
        DB      '8',158,161,161,9EH,161,161,9EH,0,0
        DB      '9',158,161,161,9FH,81H,81H,9EH,0,0
        DB      ':',80H,176,176,80H,176,176,80H,0,0
        DB      ';',80H,98H,98H,80H,84H,90H,80H,0,0
        DB      '<',84H,88H,90H,160,90H,88H,84H,0,0
        DB      '=',80H,190,190,80H,190,190,80H,0,0
        DB      '>',90H,88H,84H,82H,84H,88H,90H,0,0
        DB      '?',9CH,162,82H,84H,88H,80H,88H,0,0
        DB      '@',9CH,178,210,210,204,160,9EH,0,0
```

```
PRINT$MATRIX:
        MOV     A,M
        RAL
        RNC
        MVI     C,7             ;number of rotates
PMLOOP:
        XCHG                    ;Put print character in E
        LHLD    PTCHR
        XCHG
        RAL
        JC      $+5
        MVI     E,20H
        CALL    LISTER
        DCR     C
        JNZ     PMLOOP
        CALL    SPACE
        CALL    SPACE
        MOV     A,L             ;adjust HL pointer
        ADI     9
        MOV     L,A
        JNC     $+4
        INR     H
        JMP     PRINT$MATRIX

RESET$PHEAD:
        MVI     E,0DH
        JMP     LISTER

CRLF    MVI     E,20H
        CALL    LISTER
        MVI     E,0AH
        JMP     LISTER

SPACE   MVI     E,20H
        JMP     LISTER

LISTER  PUSH    PSW
        PUSH    H
        PUSH    D
        PUSH    B
        MVI     C,LPCMD
        CALL    BDOS
        POP     B
        POP     D
        POP     H
        POP     PSW
        RET

;-----------------------------------------------------------------
; EQUATES
;-----------------------------------------------------------------

CPM$IN$BUF      EQU     80H
CLCMD           EQU     9       ;CONSOLE LINE COMMAND
BDOS            EQU     5
CHR1            EQU     'A'
CHR2            EQU     'W'
CHR3            EQU     'O'
LPCMD           EQU     5       ;LINE PRINT COMMAND
MAXCHR          EQU     17

;-----------------------------------------------------------------
; STORAGE
;-----------------------------------------------------------------

        DB      'A',190,227,227,255,227,227,227,0,0
        DB      'B',254,227,227,254,227,227,254,0,0
        DB      'C',190,227,224,224,224,227,190,0,0
        DB      'D',254,227,227,227,227,227,254,0,0
        DB      'E',255,224,224,252,224,224,255,0,0
        DB      'F',255,224,224,248,224,224,224,0,0
        DB      'G',190,227,224,224,231,227,190,0,0
        DB      'H',227,227,227,255,227,227,227,0,0
        DB      'I',158,140,140,140,140,140,158,0,0
        DB      'J',83H,83H,83H,83H,83H,179,9EH,0,0
        DB      'K',227,230,236,248,252,230,227,0,0
        DB      'L',224,224,224,224,224,224,255,0,0
        DB      'M',193,227,247,235,227,227,227,0,0
        DB      'N',195,227,243,235,231,227,225,0,0
        DB      'O',190,227,227,227,227,227,190,0,0
        DB      'P',254,227,227,254,224,224,224,0,0
        DB      'Q',190,227,227,227,227,231,191,0,0
        DB      'R',254,227,227,254,248,236,230,0,0
        DB      'S',191,224,224,190,131,131,254,0,0
        DB      'T',254,152,152,152,152,152,152,0,0
        DB      'U',227,227,227,227,227,227,190,0,0
        DB      'V',193,161,179,146,158,140,140,0,0
        DB      'W',227,227,227,235,247,227,193,0,0
        DB      'X',227,182,156,156,156,182,227,0,0
        DB      'Y',227,182,156,140,140,140,140,0,0
        DB      'Z',255,130,132,136,144,160,255,0,0
        DB      '[',128,128,128,128,128,128,128,0,0
        DB      '\',128,128,128,128,128,128,128,0,0
        DB      ']',128,128,128,128,128,128,128,0,0
        DB      '^',128,128,128,128,128,128,128,0,0
        DB      '_',128,128,128,128,128,128,128,0,0
        DB      '`',128,128,128,128,128,128,128,0,0

;-----------------------------------------------------------------
;
; FORMAT FOR THE PRINTING TABLE
;
;
;               line line line line line line line line line
;  0000       ! 01 ! 02 ! 03 ! 04 ! 05 ! 06 ! 07 ! 08 ! 09 !
;       ------------------------------------------------------
;       !     !  7 or 9 bytes of hex code
;  1st letter!     one hex code for each print line
;            !
;  0009      !
;       !    !       start with 7 by 7 matrix
;  2nd letter!         later we can use byte 8 & 9 for decenders
;            !
;  0012      !
;       !    !
;  3rd letter!
;            !
;
;      ^-----------each letter is 9 bytes apart. If bit 7 set
;                   then it is a character to be printed. A 00
;                   in any position designates the end of the
;                   print line
;
; PRINT$BUFFER: DS    9*14    ;Maximum of 14 printable chars.
;
;-----------------------------------------------------------------

        END
```

PUT A DAISY ON YOUR APPLE

Continued from Page 78

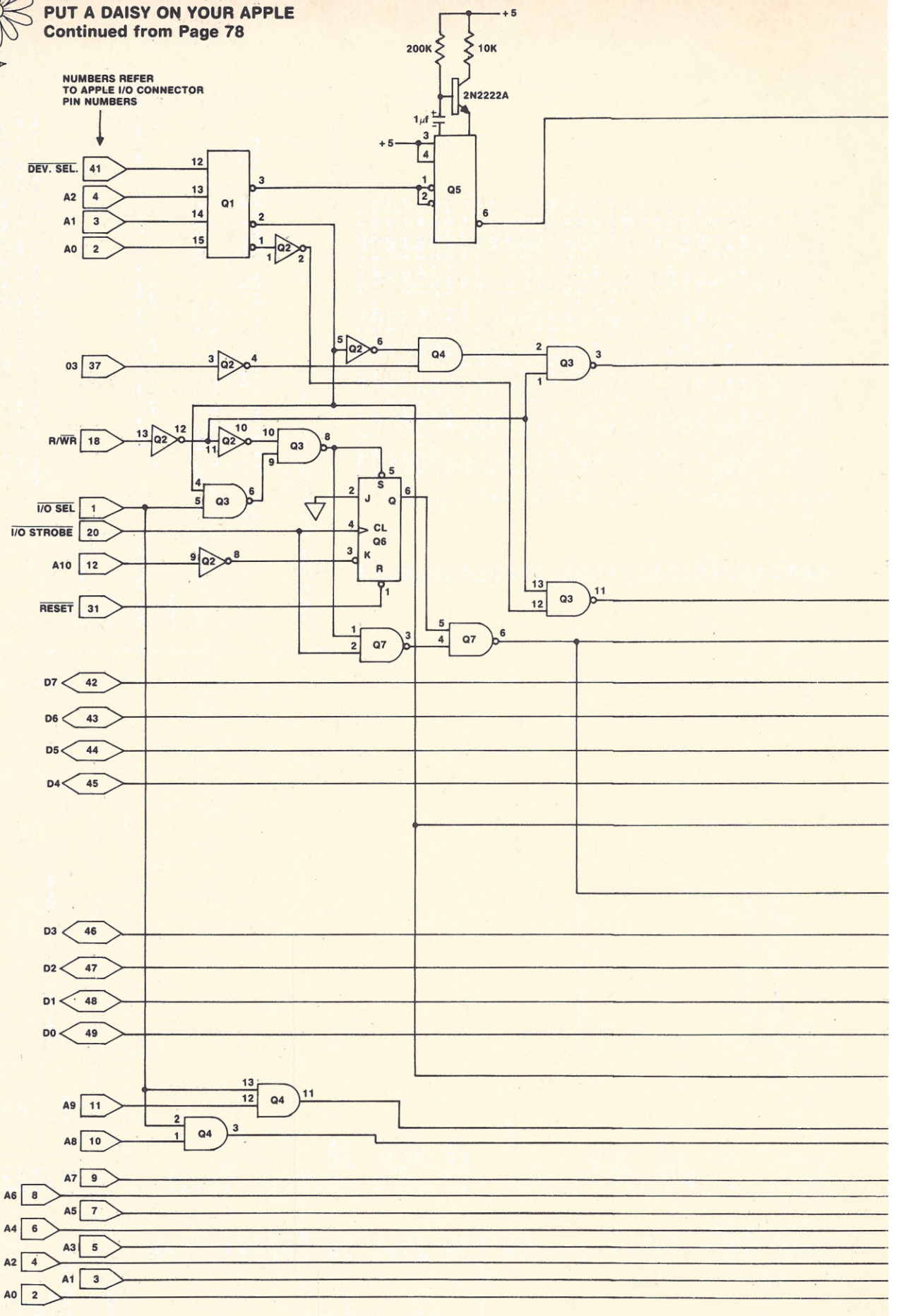
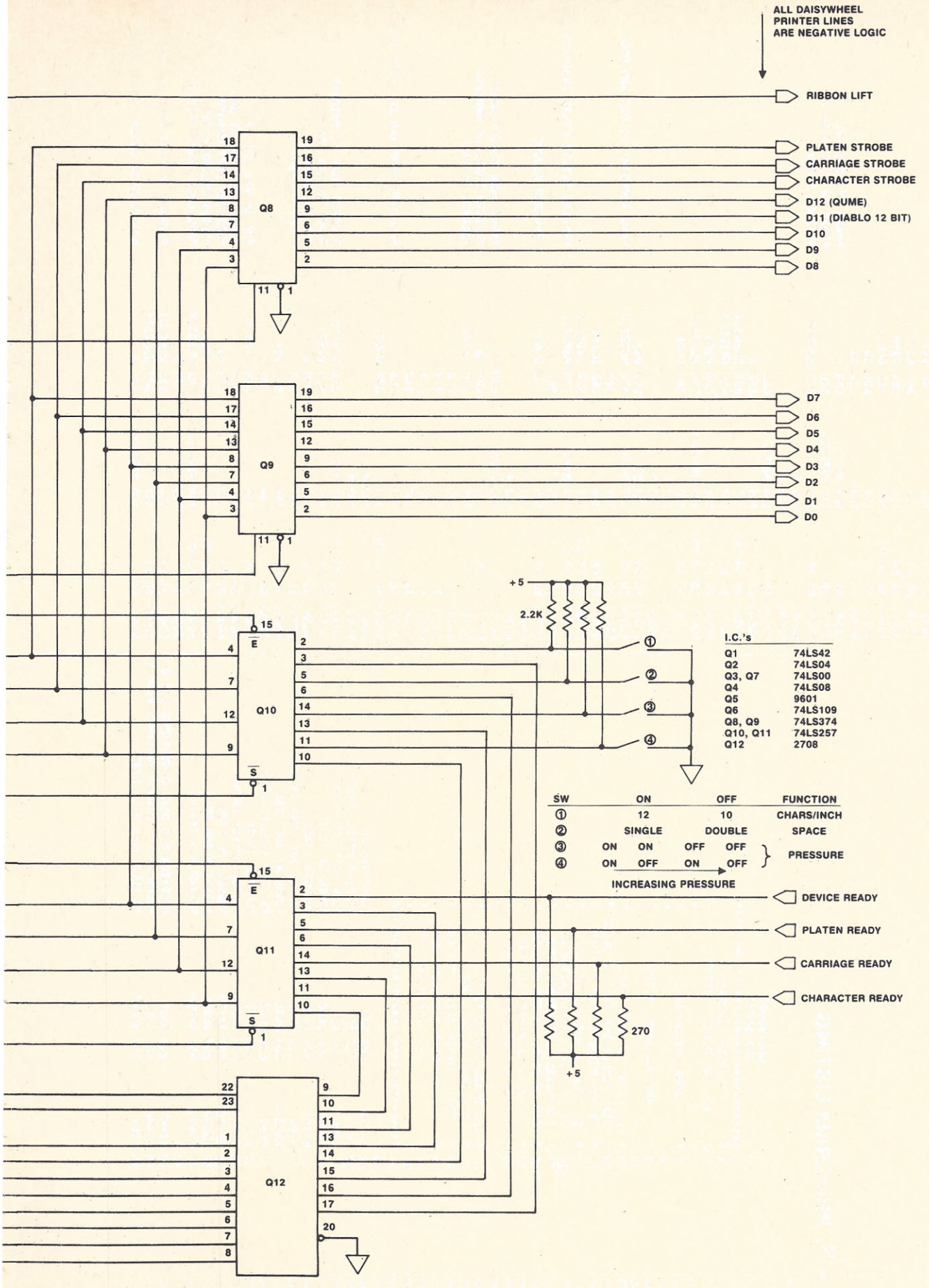


Figure 1. Parallel interface logic for daisywheel



printers (Qume, Diablo) connected to the Apple II.



PROGRAM LISTING

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:ASM

6000:                1            ORG $6000
6000:                2            OBJ $6000
6000:                3 *********************************
6000:                4 *       PRINTER FIRMWARE        *
6000:                5 *    FOR THE DIABLO HYTYPE I    *
6000:                6 *                               *
6000:                7 *      JOHN  MACDOUGALL         *
6000:                8 *                               *
6000:                9 *     REVISED APRIL 4,1979      *
6000:               10 *                               *
6000:               11 * THE FIRST 256 BYTES ARE       *
6000:               12 *  ESSENTIALLY THE SAME AS THOSE *
6000:               13 *  IN THE PRINTER CARD FIRMWARE  *
6000:               14 *  WRITTEN BY WOZ AND REVISED    *
6000:               15 *  ON 3/17/78.  EXPLANATION OF   *
6000:               16 *  THE DIABLO DRIVER ROUTINES    *
6000:               17 *  CAN BE FOUND IN THE ARTICLE   *
6000:               18 *  BY JM IN INTERFACE AGE P98    *
6000:               19 *  OF THE OCTOBER 1978 ISSUE.    *
6000:               20 *                               *
6000:               21 * THE DIABLO PORTS ARE:         *
6000:               22 *   C080+N0=LOW DATA OUT        *
6000:               23 *   C081+N0=HIGH DATA + STROBES *
6000:               24 *   C081+N0=READ THE SETUP SWS  *
6000:               25 *           AND DIABLO READIES  *
6000:               26 *                               *
6000:               27 *********************************
6000:               28 *
6000:               29 LSTRT       EQU $20          *LEFT MARGIN
6000:               30 CH          EQU $24          *CURSOR HORIZ INDEX
6000:               31 CSWL        EQU $36          *LOW ORDER COUT SW
6000:               32 PWDTH       EQU $4B8         *PRINTER WIDTH
6000:               33 MSTRT       EQU $538         *MARGIN START
6000:               34 MODE        EQU $5B8         *AFTER ESC CHAR IN B7
6000:               35 ESCHAR      EQU $638         *CURRENT ESC CHAR
6000:               36 FLAGS       EQU $6B8         *B7=VID ALSO,B0=CRLF
6000:               37 COL         EQU $738         *COLUMN COUNT
6000:               38 COUT1       EQU $FDF0        *VIDEO OUTPUT ENTRY
6000:               39 SETKBD      EQU $FE89        *RESETS TO PR#0
6000:               40 PRERR       EQU $FF2D        *PRINT ERROR SUBR.
6000:               41 IORTS       EQU $FF58        *FIXED RTS INSTRN
6000:               42 *
6000:               43 ATEMP       EQU $678         *SCRATCH FOR DIABLO ROUTINES LOW B
6000:               44 BTEMP       EQU $6F8         *SCRATCH FOR DIABLO ROUTINES HIGH B
6000:               45 HOUT        EQU $C081        *DIABLO DATA HIGH BYTE

6047: C9 11         103            CMP #$11
6049: B0 09         104            BCS ESCTST
604B: 09 F0         105            ORA #$F0
604D: 3D 38 07      106            AND COL,X
6050: 65 24         107            ADC CH
6052: 85 24         108            STA CH
6054: 4A            109 ESCTST     LSR A            *MAKE IT POSITIVE
6055: 38            110 DEFAULT    SEC              *CHAR IN Y, CN# IN X
6056: B0 67         111            BCS ESCTST1      *BRANCH ALWAYS
6058:               112 *
6058:               113 *
6058: 18            114 SETFLG     CLC
6059: 6A            115            ROR A
605A: 3D B8 06      116            AND FLAGS,X
605D: 90 02         117            BCC SETFLG1
605F: 49 81         118            EOR #$81
6061: 9D B8 06      119 SETFLG1    STA FLAGS,X
6064: D0 4F         120            BNE DONE
6066:               121 *
6066:               122 *
6066: A0 0A         123 DIG        LDY #$A
6068: 7D 38 05      124 DLOOP      ADC MSTRT,X      *ADD 10*MSTRT TO DIG AND STORE
606B: 88            125            DEY
606C: D0 FA         126            BNE DLOOP
606E: 9D B8 04      127            STA PWDTH,X
6071: 9D 38 05      128 MINIT      STA MSTRT,X      *UPDATE MARGIN START INDICATE AFTER
6074: 38            129            SEC
6075: B0 3F         130            BCS DONE1         *BRANCH ALWAYS
6077:               131 *
6077:               132 *
6077:               133 VIDEO      EQU *            *MUST KEEP CURSOR HORIZ
6077: C5 24         134            CMP CH           *WITHIN RANGE OF WNDWDTH
6079: 90 36         135            BCC SETCH        *BRANCH IF >40
607B: 68            136            PLA
607C: A8            137            TAY
607D: 68            138            PLA
607E: AA            139            TAX
607F: 68            140            PLA              *RESTORE REGS AND END WITH VIDEO OUT
6080: 4C F0 FD      141            JMP COUT1
6083:               142 *
6083:               143 *
6083: 20 00 C9      144 OUT        JSR STARTD       *OUTPUT CHAR TO PRINTER
6086: 90 5F         145            BCC PRNT1        *LOOP IF WAS TAB
6088: 49 07         146            EOR #7           *IF CR, MAKE IT LF
608A: A8            147            TAY              *COPY TO REG. Y
608B: 49 0A         148            EOR #$A
608D: 0A            149            ASL A
608E: D0 06         150            BNE FINISH       *BR IF WAS NOT CR
6090: B8            151            CLV              *INDICATE THAT IT WAS CR
6091: 85 24         152            STA CH           *SET THE LEFT MARGIN
6093: 9D 38 07      153            STA COL,X        *CLEAR COLUMN COUNT
6096: BD B8 06      154 FINISH     LDA FLAGS,X      *FOR CRLF CHECK (BIT,0)
6099: 4A            155            LSR A
609A: 70 02         156            BVS FINISH1      *BRANCH IF LAST CHAR WAS NOT CR
609C: B0 21         157            BCS ESCTST1
609E: 0A            158 FINISH1    ASL A            *CHECK HIGH ORDER BIT OF FLAGS
```

```
6000:                 46 LOUT        EQU $C080          *DIABLO DATA LOW BYTE
6000:                 47 LCARP       EQU $3B8           *DIABLO CARRIAGE POSITION LOW BYTE
6000:                 48 HCARP       EQU $438           *DIABLO CARRIAGE POSITION HIGH BYTE
6000:                 49 RESET       EQU $CFFF          *OVERLAY RESET ADDRESS
6000:                 50 RIBBON      EQU $C082          *RIBBON LIFT
6000:                 51 *
6000:                 52 *
6000:                 53 *THE APPLE PRINTER ROUTINES START HERE
6000:                 54 *
6000: 18              55 ENT0        CLC                *DEFAULT ENTRY
6001: B0 FF           56             BCS ENT1           *FAKE TO HIDE CARRY SET
6002:                 57             ORG ENT0+$2
6002:                 58             OBJ ENT0+$2
6002: 38              59 ENT1        SEC                *NORMAL ENTRY
6003: 48              60             PHA
6004: 8A              61             TXA
6005: 48              62             PHA                *SAVE THE REGISTERS
6006: 98              63             TYA
6007: 48              64             PHA
6008: 08              65             PHP
6009: 78              66             SEI
600A: 8D FF CF        67             STA RESET          *RESET ANY OVERLAYS
600D: 20 58 FF        68             JSR IORTS          *GET THE $CN IN STACK
6010: BA              69             TSX
6011: 68              70             PLA
6012: 68              71             PLA
6013: 68              72             PLA
6014: 68              73             PLA
6015: A8              74             TAY                *CHAR TO Y-REGISTER
6016: CA              75             DEX
6017: 9A              76             TXS                *GET $CN
6018: 68              77             PLA
6019: 28              78             PLP
601A: AA              79             TAX                *$CN TO REG X
601B: 90 38           80             BCC DEFAULT        *FIRST ENTRY
601D: BD B8 05        81             LDA MODE,X         *AFTER ESC CHAR?
6020: 10 19           82             BPL ESCTEST        *BRANCH IF NO
6022: 98              83             TYA                *CHAR TO A REGISTER
6023: 29 7F           84             AND #$7F           *MASK OUT BIT 7
6025: 49 30           85             EOR #$30           *ALTER BITS
6027: C9 0A           86             CMP #$A            * 0 TO 9?
6029: 90 3B           87             BCC DIG            *BRANCH IF YES
602B: C9 78           88             CMP #$78           *H TO 0?
602D: B0 29           89             BCS SETFLG         *YES,SET OR CLR FLGS
602F: 49 3D           90             EOR #$3D           *CHECK FOR CR
6031: F0 21           91             BEQ ESCTST         *DON'T CH ESC IF CR
6033: 98              92             TYA                *GET ORIGINAL CHAR AGAIN
6034: 29 9F           93             AND #$9F           *MAKE IT A CONTROL CHAR
6036: 9D 38 06        94             STA ESCHAR,X       *STORE NEW ESC CHAR
6039: 90 7A           95 DONE0       BCC DONE           *BRANCH ALWAYS
603B:                 96 *
603B:                 97 *
603B: BD B8 06        98 ESCTEST     LDA FLAGS,X
603E: 30 14           99             BMI ESCTST
6040: A5 24          100             LDA CH
6042: DD 38 07       101             CMP COL,X
6045: B0 0D          102             BCS ESCTST
```

```
609F: 0A             159             ASL A
60A0: A9 27          160             LDA #$27           *LOADED JUST FOR VIDEO MODE
60A2: B0 D3          161             BCS VIDEO
60A4: BD 38 07       162             LDA COL,X          *CHECK FOR WITHIN 8 CHARS
60A7: FD B8 04       163             SBC PWDTH,X        * OF THE PRINTER WIDTH
60AA: C9 F8          164             CMP #$F8
60AC: 90 03          165             BCC SETCH
60AE: 69 27          166             ADC #$27           *ADD 32 FORMING 32-39
60B0: AC 58 FF       167 DUM         LDY IORTS          *DUMMY LDY ABSOLUTE
60B1:                168             ORG DUM+1
60B1:                169             OBJ DUM+1
60B1: A9 00          170 SETCH       LDA #0
60B3: 85 24          171 SETCH1      STA CH
60B5: 18             172 DONE        CLC
60B6: 7E B8 05       173 DONE1       ROR MODE,X
60B9: 68             174             PLA
60BA: A8             175             TAY
60BB: 68             176             PLA
60BC: AA             177             TAX
60BD: 68             178             PLA
60BE: 60             179             RTS
60BF:                180 *
60BF:                181 *
60BF: 10 14          182 ESCTST1     BPL ESCTST2
60C1:                183 *
60C1:                184 *
60C1: 20 7B CA       185 DFALT1      JSR INIT           *INITIALIZE ON ENTRY
60C4: A9 89          186             LDA #$89           *CONTROL I
60C6: 9D 38 06       187             STA ESCHAR,X
60C9: 9D B8 06       188             STA FLAGS,X        *VIDEO ALSO, CRLF ON
60CC: A9 28          189             LDA #$28
60CE: 9D B8 04       190             STA PWDTH,X
60D1: A9 02          191             LDA #ENT1
60D3: 85 36          192             STA CSWL           *SET FOR NORMAL ENTRY
60D5: 98             193 ESCTST2     TYA                *MOVE CHAR TO REG-A
60D6: 5D 38 06       194             EOR ESCHAR,X
60D9: 0A             195             ASL A              *ESC CHAR? (7LSB'S)
60DA: F0 95          196             BEQ MINIT          *BRANCH IF YES
60DC: 5E B8 05       197             LSR MODE,X         *NO, CLR AFTER ESC CHAR
60DF: 98             198             TYA                *CHAR TO STACK
60E0: 48             199             PHA
60E1: 8A             200             TXA
60E2: 0A             201             ASL A
60E3: 0A             202             ASL A              * GENERATE N#$10 AS AN INDEX
60E4: 0A             203             ASL A
60E5: 0A             204             ASL A
60E6: A8             205             TAY
60E7: BD 38 07       206 PRNT1       LDA COL,X
60EA: C5 24          207             CMP CH             *IF COLUMN>= CURSOR HORIZ
60EC: 68             208             PLA                     *THEN USE CHAR
60ED: B0 05          209             BCS CTLTST
60EF: 48             210             PHA
60F0: 29 80          211             AND #$80           *ELSE GEN BLANK (7LSB'S)
60F2: 09 20          212             ORA #$20           *FOR TAB CATCH UP
60F4: 2C 58 FF       213 CTLTST      BIT IORTS
60F7: F0 03          214             BEQ PRNT2          *INCR COLUMN COUNT
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```
60F9: FE 38 07    215             INC COL,X           *IF NOT A CONTROL CHAR
60FC: 70 85       216 PRNT2       BVS OUT             *TAKEN WHEN PRINTER READY
C900:             217             ORG $C900
C900:             218             OBJ $6100
C900:             219 ************************************************
C900:             220 *
C900:             221 *THE MAIN DIABLO DRIVER ROUTINE STARTS HERE
C900:             222 *
C900:             223 *WHILE THE ABOVE CODE IS RELOCATABLE
C900:             224 *AND ACCESSED ON A SLOT BASIS
C900:             225 *THE FOLLOWING CODE IS FIXED AT
C900:             226 *C900 AND ABOVE.
C900:             227 *
C900:             228 *
C900: 8D 78 06    229 STARTD      STA ATEMP           *SAVE THE BYTE
C903: 48          230             PHA
C904: 8A          231             TXA
C905: 48          232             PHA
C906: 98          233             TYA
C907: 48          234             PHA
C908: 08          235             PHP
C909: A9 E0       236             LDA #$E0            *INITIALIZE THE STROBES
C90B: 99 81 C0    237             STA HOUT,Y
C90E: AD 78 06    238             LDA ATEMP
C911: 29 7F       239             AND #$7F            *STRIP PARITY
C913: 8D 78 06    240             STA ATEMP
C916: C9 21       241             CMP #$21            *IF THE BYTE IS
C918: 90 38       242             BCC SPACE           * NON-ASCII THEN
C91A: C9 7F       243             CMP #$7F            * GO AND SEE
C91C: F0 34       244             BEQ SPACE           * WHAT TO DO
C91E: B9 81 C0    245 PRASC       LDA HOUT,Y          *GET THE PRESSURE
C921: 6A          246             ROR A
C922: 6A          247             ROR A
C923: 29 0C       248             AND #$C
C925: 09 E0       249             ORA #$E0
C927: 8D F8 06    250             STA BTEMP
C92A: 99 82 C0    251             STA RIBBON,Y        *SET RIBBON LIFT
C92D: AD 78 06    252             LDA ATEMP
C930: 49 FF       253             EOR #$FF            *INVERT FOR NEGATIVE LOGIC
C932: EA          254             NOP                 *THE QUME NEEDS AN ASL A (CODE '0A')
C933: 99 80 C0    255             STA LOUT,Y          *DATA TO PRINTER
C936: B9 81 C0    256 PRN1        LDA HOUT,Y          *PR WHEEL STATUS
C939: 29 01       257             AND #$01
C93B: D0 F9       258             BNE PRN1
C93D: AD F8 06    259             LDA BTEMP
C940: 29 DE       260             AND #$DE
C942: 99 81 C0    261             STA HOUT,Y          *SET STROBE
C945: 09 20       262             ORA #$20
C947: 99 81 C0    263             STA HOUT,Y          *AND UNSTROBE
C94A: 29 E0       264             AND #$E0
C94C: 99 81 C0    265             STA HOUT,Y          *DROP THE RIBBON
C94F: 4C 56 C9    266             JMP SPC1
C952:             267 *THESE ROUTINES DO THE VARIOUS PRINTER FUNCTIONS
C952: C9 20       268 SPACE       CMP #$20
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C9C1: 29 80       322             AND #$80
C9C3: D0 03       323             BNE TENCI
C9C5: A9 0A       324             LDA #$A             *12 CHARS/IN
C9C7: 60          325             RTS
C9C8: A9 0C       326 TENCI       LDA #$C             *10 CHARS/IN
C9CA: 60          327             RTS
C9CB:             328 *SET PLATEN SPACING FROM THE SW POSITION
C9CB: A9 00       329 LINSP       LDA #$0
C9CD: 8D F8 06    330             STA BTEMP
C9D0: B9 81 C0    331             LDA HOUT,Y
C9D3: 29 40       332             AND #$40
C9D5: D0 06       333             BNE LINS2
C9D7: A9 08       334             LDA #$8              *SINGLE SPACE
C9D9: 8D 78 06    335             STA ATEMP
C9DC: 60          336             RTS
C9DD: A9 10       337 LINS2       LDA #$10            *DOUBLE SPACE
C9DF: 8D 78 06    338             STA ATEMP
C9E2: 60          339             RTS
C9E3:             340 *MOVES THE CARRIAGE
C9E3: AD 78 06    341 CARMV       LDA ATEMP           *GET LOW BYTE
C9E6: 49 FF       342             EOR #$FF
C9E8: 99 80 C0    343             STA LOUT,Y
C9EB: AD F8 06    344             LDA BTEMP           *GET THE HIGH BYTE
C9EE: 49 FF       345             EOR #$FF             *CMA
C9F0: 29 0F       346             AND #$0F            *LOW NIBBLE
C9F2: 09 E0       347             ORA #$E0            *STROBES OFF
C9F4: 99 81 C0    348             STA HOUT,Y
C9F7: 8D F8 06    349             STA BTEMP           *HOLD THE BYTE
C9FA: B9 81 C0    350 CARDY       LDA HOUT,Y          *LOOK AT READY
C9FD: 29 02       351             AND #$2
C9FF: D0 F9       352             BNE CARDY
CA01: AD F8 06    353             LDA BTEMP
CA04: 29 AF       354             AND #$AF
CA06: 99 81 C0    355             STA HOUT,Y          *STROBE IT
CA09: 09 40       356             ORA #$40
CA0B: 99 81 C0    357             STA HOUT,Y          *RESET
CA0E:             358 *KEEPS TRACK OF CARRIAGE POSITION
CA0E: D8          359             CLD
CA0F: AD F8 06    360             LDA BTEMP
CA12: 49 FF       361             EOR #$FF
CA14: 29 0F       362             AND #$0F
CA16: 8D F8 06    363             STA BTEMP
CA19: 29 08       364             AND #$8
CA1B: 18          365             CLC
CA1C: D0 13       366             BNE SUBTR
CA1E: AD 78 06    367             LDA ATEMP
CA21: 7D B8 03    368             ADC LCARP,X
CA24: 9D B8 03    369             STA LCARP,X
CA27: AD F8 06    370             LDA BTEMP
CA2A: 7D 38 04    371             ADC HCARP,X
CA2D: 9D 38 04    372             STA HCARP,X
CA30: 60          373             RTS
CA31: 38          374 SUBTR       SEC
CA32: BD B8 03    375             LDA LCARP,X
CA35: ED 78 06    376             SBC ATEMP
```

```
C954: D0 11       269             BNE BKSP
C956: A9 00       270 SPC1        LDA #00
C958: 8D F8 06    271             STA BTEMP          *SET TOP BYTE ZERO
C95B: 20 BE C9    272 SPVAL       JSR CARSP          *GET THE SPACING
C95E: 8D 78 06    273             STA ATEMP          *SAVE THE SPACING
C961: 20 E3 C9    274             JSR CARMV
C964: 4C B7 C9    275             JMP RETN
C967: C9 08       276 BKSP        CMP #$8
C969: D0 08       277             BNE CR
C96B: A9 08       278             LDA #$8
C96D: 8D F8 06    279             STA BTEMP
C970: 4C 5B C9    280             JMP SPVAL
C973: C9 0D       281 CR          CMP #$0D
C975: D0 18       282             BNE LF
C977: 20 7D C9    283             JSR CARTN
C97A: 4C B7 C9    284             JMP RETN
C97D: BD B8 03    285 CARTN       LDA LCARP,X        *LOW CARR POSN
C980: 8D 78 06    286             STA ATEMP
C983: BD 38 04    287             LDA HCARP,X        *HIGH CARR POSN
C986: 09 08       288             ORA #$8
C988: 8D F8 06    289             STA BTEMP
C98B: 20 E3 C9    290             JSR CARMV
C98E: 60          291             RTS
C98F:             292 *LINEFEED FUNCTIONS
C98F: C9 0A       293 LF          CMP #$A            *LINEFEED?
C991: D0 09       294             BNE RLINF
C993: 20 CB C9    295 LINEF       JSR LINSP
C996: 20 4F CA    296 LINF1       JSR PLTMV
C999: 4C B7 C9    297             JMP RETN
C99C: C9 0C       298 RLINF       CMP #$C
C99E: D0 0B       299             BNE RSETL
C9A0: 20 CB C9    300             JSR LINSP
C9A3: A9 08       301             LDA #$8
C9A5: 8D F8 06    302             STA BTEMP
C9A8: 4C 96 C9    303             JMP LINF1          *REVERSE THE PLATEN
C9AB:             304 *RESET THE LEFT MARGIN
C9AB: C9 0F       305 RSETL       CMP #$0F           * RESET MARGIN?
C9AD: D0 08       306             BNE RETN           *TRAP TO HOME
C9AF: A9 00       307             LDA #$0
C9B1: 9D B8 03    308             STA LCARP,X
C9B4: 9D 38 04    309             STA HCARP,X
C9B7: 28          310 RETN        PLP                *RETURN TO SYSTEM
C9B8: 68          311             PLA
C9B9: A8          312             TAY
C9BA: 68          313             PLA
C9BB: AA          314             TAX
C9BC: 68          315             PLA
C9BD: 60          316             RTS
C9BE:             317 *END OF MAIN PROGRAM
C9BE:             318 *SPECIAL SUBROUTINES FOLLOW
C9BE:             319 *
C9BE:             320 *SET CARRIAGE SPACING FROM THE SW POSITION
C9BE: B9 81 C0    321 CARSP       LDA HOUT,Y
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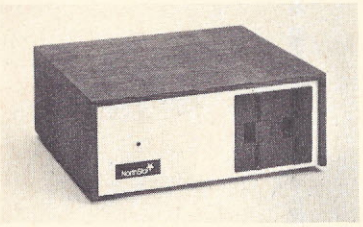
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CA38: 08          377             PHP
CA39: 9D B8 03    378             STA LCARP,X
CA3C: AD F8 06    379             LDA BTEMP
CA3F: 29 07       380             AND #$7
CA41: 8D F8 06    381             STA BTEMP
CA44: BD 38 04    382             LDA HCARP,X
CA47: 28          383             PLP
CA48: ED F8 06    384             SBC BTEMP
CA4B: 9D 38 04    385             STA HCARP,X
CA4E: 60          386             RTS
CA4F:             387 *SET AND STROBE THE PLATEN MOVEMENT
CA4F: AD 78 06    388 PLTMV       LDA ATEMP
CA52: 49 FF       389             EOR #$FF
CA54: 99 80 C0    390             STA LOUT,Y         *SET THE LOW BYTE
CA57: AD F8 06    391             LDA BTEMP
CA5A: 49 FF       392             EOR #$FF
CA5C: 29 0F       393             AND #$0F
CA5E: 09 E0       394             ORA #$E0
CA60: 99 81 C0    395             STA HOUT,Y
CA63: 8D F8 06    396             STA BTEMP
CA66: B9 81 C0    397 PLRDY       LDA HOUT,Y
CA69: 29 04       398             AND #$4
CA6B: D0 F9       399             BNE PLRDY
CA6D: AD F8 06    400             LDA BTEMP
CA70: 29 6F       401             AND #$6F
CA72: 99 81 C0    402             STA HOUT,Y
CA75: 09 80       403             ORA #$80
CA77: 99 81 C0    404             STA HOUT,Y
CA7A: 60          405             RTS
CA7B: 48          406 INIT        PHA                *SETS LEFT MARGIN ON INITIAL ENTRY
CA7C: 08          407             PHP
CA7D: A9 00       408             LDA #$0
CA7F: 9D B8 03    409             STA LCARP,X        *INIT THE CARRIAGE POSITION
CA82: 9D 38 04    410             STA HCARP,X        *    REGISTER TO ZERO
CA85: 98          411             TYA
CA86: 48          412             PHA
CA87: 8A          413             TXA
CA88: 8D F8 07    414             STA $7F8           *SET RTI LOCATION
CA8B: 0A          415             ASL A
CA8C: 0A          416             ASL A
CA8D: 0A          417             ASL A
CA8E: 0A          418             ASL A
CA8F: A8          419             TAY
CA90: A9 EF       420             LDA #$EF           *SET ALL THE STROBES OFF
CA92: 99 81 C0    421             STA HOUT,Y
CA95: 68          422             PLA
CA96: A8          423             TAY
CA97: 28          424             PLP
CA98: 68          425             PLA
CA99: 60          426             RTS

*** SUCCESSFUL ASSEMBLY: NO ERRORS
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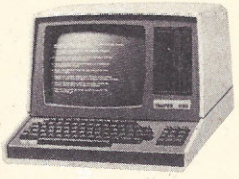
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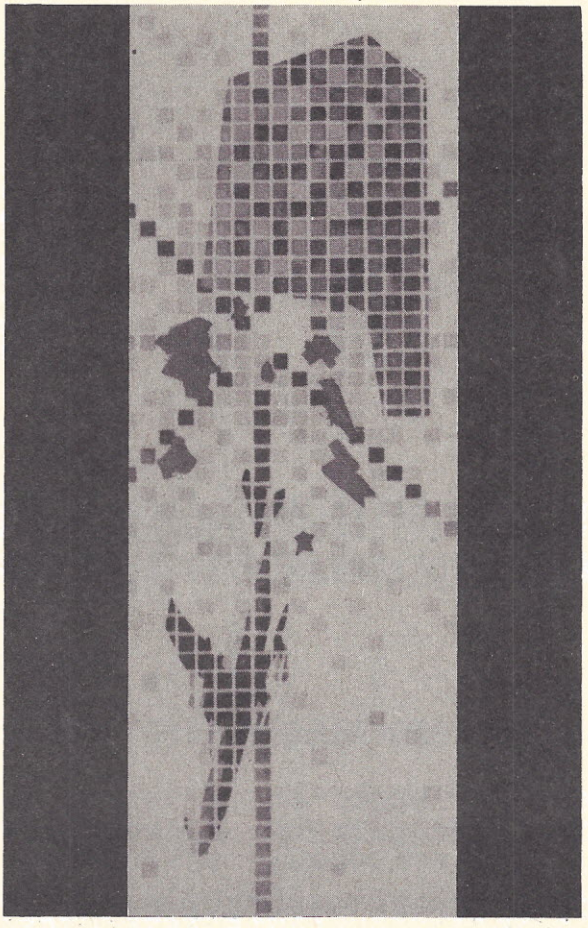
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CIRCLE INQUIRY NO. 69


```
00160 PRINT "once every seven seconds). If a key is
  ' ' depressed when the light"
00170 PRINT "is not blinking, nothing will result."
00180 GOSUB 1740
00190 PRINT "Here is a general description of the function
  ' ' of each key:"
00200 PRINT
00210 PRINT "f1    Engine 1    Moves the throttle for
  ' ' engine 1"
00220 PRINT "f2    Engine 2    Moves the throttle for
  ' ' engine 2"
00230 PRINT "f3    Engine 3    Moves the throttle for
  ' ' engine 3"
00240 PRINT "f4    Engine 4    Moves the throttle for
  ' ' engine 4"
00250 PRINT "f5    All engines    Moves the throttles for
  ' ' all engines"
00260 PRINT "Blue    Decrease    Sets decrease mode
  ' ' (Note: The 'mode'"
00270 PRINT "       determines the direction the
  ' ' throttle(s)"
00280 PRINT "       will move when f1-f4 is
  ' ' pressed)."
00290 PRINT "Red    Increase    Sets increase mode
  ' ' (Note: It is not necessary"
00300 PRINT "       to press a mode key each time
  ' ' you move the"
00310 PRINT "       throttles. Rather, the
  ' ' computer will use"
00320 PRINT "       the most recent mode that was
  ' ' typed)."
00330 PRINT "White   Reverse    Sets reverse mode.
  ' ' This will reverse your"
00340 PRINT "       engines and apply a negative
  ' ' thrust. By"
```



FLY YOUR COMPUTER
Continued from Page 74

File [FLIGHT.BAS]Page #1

```
00010 PRINT CHR$(27);CHR$(69)
00020 PRINT TAB(26);"Boeing 747 flight simulator"
00030 PRINT
00040 PRINT "  You are the captain of TWA flight 409,
 ' '  non-stop service to"
00050 PRINT "Hartford (Bradley Field in Windsor Locks) from
 ' '  New York's"
00060 PRINT "Kennedy International Airport. Flight 409
 ' '  departs at 1:20 pm."
00070 PRINT "EST (or 1920 GMT) and is due to arrive in
 ' '  Hartford at 2:00 pm."
00080 PRINT
00090 LINE INPUT "Do you desire complete instructions? ";A$
00100 IF LEFT$(A$,1)="Y" THEN CHAIN "INSTRUCT"
00110 CHAIN "DISPLAY"
```

END OF FILE
PRINTED 15-Sep-79

File [INSTRUCT.BAS]Page #1

```
00010 PRINT CHR$(27);CHR$(69);
00020 PRINT "  This program is a simulation of a Boeing 747
 ' '  airplane."
00030 PRINT "Your objective is to pilot your plane from New
 ' '  York to"
00040 PRINT "Hartford. To accomplish this task, you must be
 ' '  able to"
00050 PRINT "taxi to the proper runway, take off, navigate,
 ' '  land, and"
00060 PRINT "taxi to the proper gate. The instructions that
 ' '  follow will"
00070 PRINT "outline the steps you must take."
00080 PRINT "  In addition, you will need a navigation map
 ' '  and a"
00090 PRINT "keyboard layout. These are supplied with the
 ' '  game."
00100 PRINT "  Commands are entered into the computer by
 ' '  typing the key"
00110 PRINT "corresponding with the desired command. (Refer
 ' '  to the"
00120 PRINT "keyboard layout sheet for the following) For
 ' '  example, if you"
00130 PRINT "desire to lower the landing gear, you simply
 ' '  type 'G'. The"
00140 PRINT "computer will only recognize an input from the
 ' '  user when the"
00150 PRINT "control light on the left steering wheel is
 ' '  blinking (about"
00350 PRINT "                    pressing this key again, the
 ' '  engines will"
00360 PRINT "                    return to forward thrust."
00370 PRINT "Tab     Reserve brake     Applies the reserve
 ' '  brake (Only for emergency)."
00380 PRINT "E     Window heat     Turns off the window
 ' '  heat."
00390 GOSUB 1740
00400 PRINT "Y       Set frequency   Used to set the radio
 ' '  frequency (Note: after"
00410 PRINT "                    typing this key, the computer
 ' '  will start"
00420 PRINT "                    asking you to type the
 ' '  NORMALIZE key, and"
00430 PRINT "                    then the 5 digits of the
 ' '  frequency (One at"
00440 PRINT "                    a time). You must then press
 ' '  the NORMALIZE"
00450 PRINT "                    key when finished. The
 ' '  computer will prompt"
00460 PRINT "                    you for all this information,
 ' '  but be ready!"
00470 PRINT "Return  Normalize       Used to maintain all
 ' '  systems"
00480 PRINT "                    (Throttles, flap angle,
 ' '  horizon, brake)."
00490 PRINT "                    If the light on the steering
 ' '  wheel blinks"
00500 PRINT "                    and you don't enter a
 ' '  command, the computer"
00510 PRINT "                    will use the previous
 ' '  command. If you do not"
00520 PRINT "                    want the previous command
 ' '  executed again, and"
00530 PRINT "                    you do not have a command at
 ' '  the particular time,"
00540 PRINT "                    then press the NORMALIZE key.
 ' '  (Example- You"
00550 PRINT "                    have just pulled the stick
 ' '  back (Keypad key 2)"
00560 PRINT "                    and the flap went to 5
 ' '  degrees. You wish to"
00570 PRINT "                    keep the flap there, but you
 ' '  have no new"
00580 PRINT "                    command. By pressing the
 ' '  NORMALIZE key, the"
00590 PRINT "                    flap stays at 5 and no new
 ' '  command is processed)."
00600 PRINT "A     Radio on     Turns on the radio
 ' '  (Necessary before you can"
00610 PRINT "                    begin to taxi)."
00620 GOSUB 1740
00630 PRINT "D       Radio off       Turns off the radio."
00640 PRINT "F     Window heat     Turns on the window heat
 ' '  (Necessary to have on"
```

```
00650 PRINT "                    after climbing past 10,000
  ' '  feet, or the window"
00660 PRINT "                    will fog up and you won't be
  ' '  able to see the runway"
00670 PRINT "                    when landing)."
00680 PRINT "G     Gear down      Lowers the landing gear."
00690 PRINT "H     Gear up          Raises the landing
  ' '  gear."
00700 PRINT "Z     Brake decrease     Lets up on the brake."
00710 PRINT "X     Reserve brake     Releases the reserve
  ' '  brake."
00720 PRINT "Space   Brake           Applies the brake."
00730 PRINT
00740 PRINT "    The following keys are on the keypad on
  ' '  the right of the terminal."
00750 PRINT
00760 PRINT "0     Auto Pilot     Turns on the auto pilot
  ' '  (Maintains the airspeed"
00770 PRINT "                    and levels out the aircraft
  ' '  so that the"
00780 PRINT "                    vertical speed = 0000."
00790 PRINT ".     Auto Pilot     Turns off the auto pilot."
00800 PRINT "2     Stick back     Increases the flap angle
  ' '  (Tilts the plane up)."
00810 PRINT "8     Stick forward     Decreases the flap
  ' '  angle (Tilts the plane down)."
00820 PRINT "5     Stick center     Brings the flap angle
  ' '  and horizon angle to zero."
00830 PRINT "4     Wheel left     Tilts the plane left
  ' '  (Decreases the horizon angle)."
00840 PRINT "6     Wheel right     Tilts the plane right
  ' '  (Increases the horizon angle)."
00850 GOSUB 1740
00860 PRINT "  The displayed values of the instruments are
  ' '  in the following units:"
00870 PRINT
00880 PRINT "Air speed (ASP)          Miles per hour"
00890 PRINT "Horizon (HOR)          Degrees"
00900 PRINT "Altitude (ALT)          Feet"
00910 PRINT "Time (GMT)              Hours and minutes, GMT"
00920 PRINT "Fuel (FUEL)             Pounds"
00930 PRINT "Heading (HDG)          Degrees"
00940 PRINT "Brake pressure (BPR)    Pounds per square inch"
00950 PRINT "Vertical speed (VSP)     Feet per minute"
00960 PRINT "Longitude (LON)          Degrees"
00970 PRINT "Latitude (LAT)          Degrees"
00980 PRINT "Radio Frequency (VHF)   Mhz"
00990 PRINT
01000 PRINT "  Most of these instruments will be on the
  ' '  left side of the"
01010 PRINT "display. Some of the indicators will be
  ' '  repeated on the right side"
01020 PRINT "of the display. These are for the co-pilot and
  ' '  will not be used in"
01030 PRINT "the simulation."
01350 PRINT "                    feet and your plane is over the
  ' '  airport (Note:"
01360 PRINT "                    You must turn on the window
  ' '  heat in order to"
01370 PRINT "                    clear the window before
  ' '  landing). When the"
01380 PRINT "                    landing gear touch the ground,
  ' '  the vertical"
01390 PRINT "                    speed must not be less than
  ' '  -450 Ft./Min. or"
01400 PRINT "                    you will damage the aircraft.
  ' '  After landing"
01410 PRINT "                    reversing the engines will help
  ' '  to slow you"
01420 PRINT "                    down (Caution: Be sure to press
  ' '  the reverse key"
01430 PRINT "                    again after you have slowed
  ' '  down! This will"
01440 PRINT "                    put the engines back into
  ' '  forward and permit you"
01450 PRINT "                    to taxi)."
01460 PRINT
01470 PRINT "TAXI TO GATE:          The tower will give you
  ' '  instructions on how to"
01480 PRINT "                    proceed to the proper gate.
  ' '  Once you arrive at"
01490 PRINT "                    the gate (You will see the
  ' '  sign), Apply full"
01500 PRINT "                    brake and shut down the
  ' '  engines."
01510 GOSUB 1740
01520 PRINT "  All instructions from the tower will be
  ' '  transmitted over the"
01530 PRINT "radio (Printed out on the Alternate Terminal).
  ' '  Make sure that"
01540 PRINT "this device is on before you begin the
  ' '  simulation."
01550 PRINT "  There are a few instruments on the display
  ' '  that require"
01560 PRINT "further explaination. In the center of the
  ' '  display you will"
01570 PRINT "find a box that is divided into four rows and
  ' '  four columns."
01580 PRINT "These are warning lights for the engines. The
  ' '  four rows"
01590 PRINT "represent Oil Pressure (OPR), Hydrolic
  ' '  Pressure (HPR), Water"
01600 PRINT "flow (WFL), and Fire (FIR). If a light comes
  ' '  on in any of these"
01610 PRINT "four rows, you must quickly turn off the
  ' '  corresponding engine."
01620 PRINT "  The brake Pressure (BPR) indicator is on the
  ' '  left side of the"
01630 PRINT "display. If the reading drops below 60, it
  ' '  will become necessary"
```

```
01040 PRINT "  Here are a few hints that may help you at
 ' '  specific stages of"
01050 PRINT "your flight:"
01060 PRINT :GOSUB 1740
01070 PRINT "TAXI TO RUNWAY:        Always turn on the radio
 ' '  before you begin to"
01080 PRINT "                       taxi the aircraft. The tower
 ' '  will tell you"
01090 PRINT "                       which runway you must go to. To
 ' '  get to a specific"
01100 PRINT "                       runway, simply begin moving
 ' '  (Throttles up and"
01110 PRINT "                       brake partway off) and turn the
 ' '  heading to match"
01120 PRINT "                       (within 3 degrees) the runway
 ' '  number. When you"
01130 PRINT "                       reach the runway, it will
 ' '  appear in the window."
01140 PRINT
01150 PRINT "TAKEOFF:               In order to takeoff,
 ' '  your airspeed must be"
01160 PRINT "                       greater than 180 Mph and the
 ' '  flaps must be at"
01170 PRINT "                       an angle greater than zero
 ' '  degrees (Flaps up)."
01180 PRINT "                       After takeoff, be sure that the
 ' '  vertical speed"
01190 PRINT "                       does not go above 6000 Ft./Min."
01200 PRINT
01210 PRINT "NAVIGATION:            To plot your position,
 ' '  simply use the longitude"
01220 PRINT "                       and latitude coordinates on the
 ' '  display. You must"
01230 PRINT "                       follow the flight pattern (A,
 ' '  B, or C) specified"
01240 PRINT "                       by the tower. The direction you
 ' '  are going is"
01250 PRINT "                       given by the heading (HDG) on
 ' '  the display. The"
01260 PRINT "                       top of the map is 0 degrees,
 ' '  right is 90, down"
01270 PRINT "                       is 180, and left is 270."
01280 GOSUB 1740
01290 PRINT "LANDING:               In order to land your
 ' '  aircraft safely, your"
01300 PRINT "                       heading must be within 3
 ' '  degrees of the runway"
01310 PRINT "                       number specified by the tower
 ' '  (Example- If you"
01320 PRINT "                       were instructed to land on
 ' '  runway 45, your heading"
01330 PRINT "                       must be between 42 and 48). The
 ' '  runway will come"
01340 PRINT "                       into view when your altitude is
 ' '  less than 100"
01640 PRINT "to use the reserve brake when you want to slow
 ' '  down."
01650 PRINT "  The radio frequency is located at the upper
 ' '  right side of the"
01660 PRINT "display. The radio on/off indicator is on the
 ' '  lower right side"
01670 PRINT "of the display. The throttle controls are
 ' '  located just below"
01680 PRINT "the engine warning lights. As the engine slide
 ' '  switches move"
01690 PRINT "up the display, The engines will increase. As
 ' '  the brake slide"
01700 PRINT "switch moves up the display, The brake will
 ' '  release."
01710 GOSUB 1740:PRINT "  Your aircraft is due to depart in
 ' '  six minutes (At 1920)."
01720 PRINT "You'd best begin now. Good luck!"
01730 PAUSE 3000:PRINT :CHAIN "DISPLAY"
01740 PRINT :PRINT " Press the 'RETURN' key to
 ' '  continue.";:PAUSE
01750 PRINT CHR$(27);CHR$(69);:RETURN

                                    ***END OF FILE***
                                    PRINTED 15-Sep-79
```

File [DISPLAY.BAS]Page #1

```
00010 PRINT
00020 PRINT "To start up your aircraft, press the repeat
 ' '  key and then the comma"
00030 PRINT "key. Hold both keys down until you hear a
 ' '  loud, continuous beep."
00040 PAUSE 20000
00050 DATA 37R ,M↑,3R ,M↑,38R ,X
00060 DATA R ,37N ,R ,Gi,R ,38N ,R ,X
00070 DATA R ,37N ,M↑,R ,M↑,38N ,R ,X
00080 DATA R ,37N ,M↑,R ,M↑,38N ,R ,X
00090 DATA R ,37N ,M↑,R ,M↑,38N ,R ,X
00100 DATA R ,37N ,M↑,R ,M↑,38N ,R ,X
00110 DATA R ,37N ,M↑,R ,M↑,38N ,R ,X
00120 DATA 21R ,RC,RO,RM,R ,N ,3R ,RA,RU,RT,RO,R
 ' '  ,RP,RI,RL,RO,RT,15R ,N ,R ,RC
00130 DATA RO,RM,21R ,X
00140 DATA 5R ,RV,RH,RF,R ,RN,RA,RU,R ,N1,N1,N4,N5,N0,3R
 ' '  ,RO,2RF,R ,G↑,28R ,G↑
00150 DATA R ,RO,2RF,3R ,N1,N1,N0,N9,N0,R ,RV,RH,RF,R
 ' '  ,RN,RA,RU,5R ,X
```

```
00160 DATA 35R ,R1,R2,R3,R4,41R ,X
00170 DATA 5R ,RA,RS,R ,3N0,2R ,RH,RO,RR,R ,2N0,2R
 ' '  ,RA,RL,RT,R ,5N0,R ,RO,RP
00180 DATA RR,R ,4N ,R ,RF,RL,RA,RP,R ,2N0,2R ,RA,RS,R
 ' '  ,3N0,2R ,RH,RO,RR,R ,2N0
00190 DATA 2R ,RA,RL,RT,R ,5N0,6R ,X
00200 DATA 31R ,RH,RP,RR,R ,4N ,41R ,X
00210 DATA R ,RW,RI,RN,R ,N ,15R ,RV,RS,RP,R ,4N0,2R
 ' '  ,RW,RF,RL,R ,4N ,3R ,RG,RE
00220 DATA RA,RR,2R ,RF,RU,RE,RL,R ,N1,5N0,6R ,RV,RS,RP,R
 ' '  ,4N0,7R ,X
00230 DATA 13R ,RH,RD,RG,R ,N0,N9,N5,11R ,RF,RI,RR,R ,4N
 ' '  ,3R ,RU,RP
00240 DATA R ,N ,11R ,RH,RD,RG,R ,3N0,16R ,X
00250 DATA 13N ,8R ,RG,RM,RT,R ,N1,N9,N1,N5,13R ,RD,RN,R
 ' '  ,G↑,19R ,RG,RM,RT
00260 DATA R ,4N0,R ,6N ,X
00270 DATA "N ","2R ","2N ","Mr","R ","M_","2N ","2R ","8N
 ' '  ","13R ","N ","R "
00280 DATA 4N ,10R ,RB,RP,RR,R ,N7
00290 DATA N5,4R ,9N ,2R ,2N ,Mr
00300 DATA "R ","M_","2N ","2R ","N ","X"
00310 DATA N ,R ,3N ,3R ,3N ,R ,8N ,R ,RR,RB,RK
00320 DATA R ,N ,7R ,N ,R ,4N ,20R ,9N ,R ,3N ,3R ,3N ,R ,N
 ' '  ,X
00330 DATA "N ","G_","M_"
00340 DATA 2N ,3R ,2N ,Mr,Gr
00350 DATA "8N ","13R ","N ","R ","4N ","20R ","9N
 ' '  ","G_","M_"
00360 DATA 2N ,3R ,2N ,Mr,Gr,N ,X
00370 DATA 2N ,3GF,3R ,3GF,11N ,R ,RL,RO,RN,R ,N7,N3,N
 ' '  ,N3,N8,R ,N ,R ,4N ,3R ,RL
00380 DATA RO,RN,R ,2N0,N.,2N0,6R ,12N ,3GF,3R ,3GF,2N ,X
00390 DATA NR,NC,NA,2N ,3R ,14N ,R ,RL,RA,RT,R ,N4,N0,N
 ' '  ,N6,N9,R ,NB,R ,N1,N2,N3
00400 DATA N4,3R ,RL,RA,RT,R ,2N0,N.,2N0,6R ,15N ,3R ,2N
 ' '  ,NR,NC,NA,X
00410 DATA 3Gi,2N ,3R ,14N ,35R ,15N ,3R ,2N ,3Gi,X
00420 DATA 3Gi,2N ,3R ,20N ,3R ,RV,RH,RF,RC,RO,RM,2R
 ' '  ,N1,N2,N3,2R ,RV,RH,RF,RC
00430 DATA RO,RM,R ,21N ,3R ,2N ,3Gi,X
00440 DATA 5N ,3R ,20N ,2R ,RO,RN,N ,G↑,RO,2RF,2R
 ' '  ,N4,N5,N6,R ,RO,RN,N ,G↑,RO
00450 DATA 2RF,R ,21N ,3R ,5N ,X
00460 DATA 5N ,3R ,20N ,11R ,N7,N8,N9,9R ,21N ,3R ,5N ,X
00470 G$=CHR$(27)+CHR$(70)+CHR$(27)+CHR$(113)
00480 M$=CHR$(27)+CHR$(70)+CHR$(27)+CHR$(112)
00490 N$=CHR$(27)+CHR$(71)+CHR$(27)+CHR$(113)
00500 R$=CHR$(27)+CHR$(71)+CHR$(27)+CHR$(112)
00510 PRINT CHR$(27);CHR$(69):FOR L=32 TO 55
00520 C=0
00530 READ T$
00540 IF T$="X" THEN 640
00550 IF LEN(T$)=2 THEN A=1:GOTO 570
00560 A=VAL(LEFT$(T$,LEN(T$)-2))
00170 IF C1=50 THEN S1=1:GOTO 700
00180 IF C1=53 THEN S1=0:GOTO 700
00190 IF C1=56 THEN S1=2:GOTO 700
00200 IF C1=52 THEN S1=4:GOTO 700
00210 IF C1=54 THEN S1=3:GOTO 700
00220 IF C1<>32 AND C1<>90 THEN 270
00230 X=47+B:Y=65:Z1=0:GOSUB 90:PRINT N$;" ":B=B+1:IF C1=90
 ' '  THEN B=B-2
00240 IF B>4 THEN B=4
00250 IF B<0 THEN B=0
00260 X=47+B:GOSUB 90:PRINT N$;"B":GOTO 700
00270 IF C1<>48 AND C1<>46 THEN 320
00280 X=39:Y=57:Z1=0:GOSUB 90:IF C1=46 THEN A1=0:PRINT N$;"
 ' '  ":GOTO 300
00290 PRINT G$;"↑":A1=1
00300 X=40:GOSUB 90:IF A1=0 THEN PRINT G$;"↑":GOTO 700
00310 PRINT N$;" ":GOTO 700
00320 IF C1<>65 AND C1<>68 THEN 350
00330 X=54:Y=64:Z1=0:GOSUB 90:IF C1=65 THEN C=1:PRINT G$;"↑
 ' '  ":GOTO 700
00340 C=0:PRINT G$;" ↑":GOTO 700
00350 IF C1<>71 AND C1<>72 THEN 390
00360 I=C1-71:PRINT
 ' '  CHR$(27);CHR$(89);CHR$(C1-26);CHR$(77);N$;" "
00370 Z2=45:IF C1=71 THEN Z2=46
00380 PRINT CHR$(27);CHR$(89);CHR$(Z2);CHR$(77);G$;"↑":GOTO
 ' '  700
00390 IF C1<>9 THEN 410
00400 PRINT
 ' '  CHR$(27);CHR$(89);CHR$(48);CHR$(57);G$;"↑":E=1:GOTO
 ' '  700
00410 IF C1<>88 THEN 430
00420 K3=1:PRINT CHR$(27);CHR$(89);CHR$(48);CHR$(57);N$;"
 ' '  ":E=0:GOTO 700
00430 IF C1<>70 THEN 450
00440 PRINT
 ' '  CHR$(27);CHR$(89);CHR$(44);CHR$(37);G$;"↑":W=1:GOTO
 ' '  700
00450 IF C1<>69 THEN 470
00460 PRINT CHR$(27);CHR$(89);CHR$(44);CHR$(37);N$;"
 ' '  ":W=0:GOTO 700
00470 IF C1<>89 THEN 590
00480 PRINT
 ' '  CHR$(27);CHR$(89);CHR$(56);CHR$(37);CHR$(27);CHR$(123)
 ' '  ;
00490 PRINT "Input frequency ready. Press NORMALIZE";
00500 IF PIN(232)<>13 THEN 500
00510 X=0
00520 PRINT :PRINT CHR$(27);CHR$(75);:R=0:Z1=10000:FOR Z=1
 ' '  TO 5
00530 PRINT "Digit";Z;"?";
00540 Y=PIN(232):IF Y=X OR Y>57 OR Y<48 THEN 540
00550 X=Y:R=(Y-48)*Z1+R:Z1=Z1/10:PRINT :PRINT :NEXT Z:PRINT
 ' '  "Press NORMALIZE"
00560 IF PIN(232)=13 THEN PRINT
 ' '  CHR$(27);CHR$(125);CHR$(27);CHR$(75):GOTO 580
```

```
00570 P$=RIGHT$(T$,1):S$=MID$(T$,LEN(T$)-1,1):IF S$="G"
 ' '  THEN PRINT G$;
00580 IF S$="M" THEN PRINT M$;
00590 IF S$="N" THEN PRINT N$;
00600 IF S$="R" THEN PRINT R$;
00610 PRINT CHR$(27);CHR$(72):PRINT
00620 PRINT CHR$(27);CHR$(89);CHR$(L);CHR$(32+C);
00630 FOR L1=1 TO A:PRINT P$;:NEXT L1:C=C+A:GOTO 530
00640 NEXT L
00650 PRINT CHR$(27);CHR$(72);CHR$(27);CHR$(120);CHR$(49)
00660 PRINT
 ' '  CHR$(27);CHR$(120);CHR$(53);CHR$(27);CHR$(89);CHR$(56)
 ' '  ;CHR$(32)
00670 CHAIN "CONTROL"

                              ***END OF FILE***
                              PRINTED 15-Sep-79




            File [CONTROL.BAS]Page #1
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00010 C=0:L=0:K3=1:B=4:T=40.69:N=73.39:K=75:D=95:G=1915:R=11
 ' '  450:U=100000
00020 H9=RND(1)*10+5:W9=RND(1)*180+180:DIM
 ' '  O(4),H(4),W(4),F(4),E(4):POKE 8220,0
00030 PRINT CHR$(27);CHR$(120);CHR$(52)
00040 Z1=2:X=51:Y=59:Z2=T:GOSUB
 ' '  90:Y=62:Z2=100*(T-INT(T)):GOSUB 90:X=50
00050 Y=59:Z2=N:GOSUB 90:Y=62:Z2=100*(N-INT(N)):GOSUB
 ' '  90:X=42:Y=77:Z2=P
00060 GOSUB 90:Y=49:Z2=H:GOSUB 90:Z1=3:Y=40:Z2=S:GOSUB
 ' '  90:X=45:Y=49
00070 Z2=D:GOSUB 90:Z1=4:X=44:Y=57:Z2=V:GOSUB
 ' '  90:X=46:Z2=G:GOSUB 90
00080 Z1=5:X=42:Z2=L:GOSUB 90:Z1=6:X=44:Y=85:Z2=U:GOSUB
 ' '  90:GOTO 140
00090 PRINT CHR$(27);CHR$(89);CHR$(X);CHR$(Y);:IF Z1=0 THEN
 ' '  RETURN
00100 IF Z2<0 THEN PRINT CHR$(8);N$;"-";:Z2=-Z2:GOTO 120
00110 PRINT CHR$(8);R$;" ";N$;
00120 Z$=LEFT$("00000",Z1-(LEN(STR$(INT(Z2)))-2))
00130 Z$=Z$+MID$(STR$(INT(Z2)),2,LEN(STR$(INT(Z2)))-2):PRINT
 ' '  Z$:RETURN
00140 PRINT
 ' '  CHR$(27);CHR$(89);CHR$(47);CHR$(41);CHR$(27);CHR$(121)
 ' '  ;CHR$(53);
00150 PRINT CHR$(27);CHR$(123);:PAUSE 1000:C1=PIN(232)
00160 PRINT
 ' '  CHR$(27);CHR$(120);CHR$(53);CHR$(27);CHR$(125):IF
 ' '  C1=13 THEN 700
00570 GOTO 560
00580 X=40:Y=45:Z1=5:Z2=R:GOSUB 90:GOTO 700
00590 IF C1=80 THEN E1=-1:GOTO 700
00600 IF C1=81 THEN E1=1:GOTO 700
00610 IF C1<>82 THEN 630
00620 FOR Z=1 TO 4:E(Z)=-E(Z):NEXT
 ' '  Z:O9=E(1)+E(2)+E(3)+E(4):GOTO 700
00630 FOR Z=1 TO 4:IF C1<>82+Z AND C1<>87 THEN 690
00640 PRINT
 ' '  CHR$(27);CHR$(89);CHR$(51-ABS(E(Z)));CHR$(66+Z);" "
00650 IF E(Z)=0 THEN E(Z)=E(Z)+E1:GOTO 670
00660 E(Z)=SGN(E(Z))*(ABS(E(Z))+E1):IF ABS(E(Z))>4 THEN
 ' '  E(Z)=4*SGN(E(Z))
00670 IF E(Z)<0 THEN E(Z)=0
00680 PRINT
 ' '  CHR$(27);CHR$(89);CHR$(51-ABS(E(Z)));CHR$(66+Z);N$;MID
 ' '  $(STR$(Z),2,1)
00690 NEXT Z:O9=E(1)+E(2)+E(3)+E(4)
00700 T1=PEEK(8220)*.513726:POKE 8220,0:IF C=0 THEN 720
00710 ON R9+1 GOTO
 ' '  2370,2390,2410,2430,2450,2470,2490,2510,2530,2550
00720 IF V>7500 OR (L=0 AND V<-750) THEN Z=0:GOTO 1320
00730 IF L=0 AND I=1 THEN Z=2:GOTO 1320
00740 IF E(Q9)>0 AND RND(1)>.85 THEN Z=3:GOTO 1320
00750 Z1=100*(INT(G/100)):Z=G-Z1:Z=Z+T1/60:IF Z>=60 THEN
 ' '  Z=Z-60:Z1=Z1+100
00760 G=Z1+Z:U=U-105*T1/60*O9/16:IF U<=0 THEN FOR Z=1 TO
 ' '  4:E(Z)=0:NEXT Z
00770 IF L=0 AND G8=1 AND (T>41.99 OR T<41.93 OR N>72.77 OR
 ' '  N<72.66) THEN Z=1:GOTO 1320
00780 Z=S-160:IF Z<0 THEN Z=0
00790 T8=T8+(P*Z/900):IF T8<-90 THEN T8=-90
00800 T9=T8*.01745:T3=850000:IF L=0 THEN T3=1500000
00810 IF E=1 THEN B=4:K3=75
00820 A=O9/16*T3/(TAN(T9)+1)/((200000+U)*(TAN(P*.01745)+1))
00830 IF (S<180 OR O9=0) AND L>0 THEN T8=T8-10:A=32:GOTO 880
00840 IF A1=0 AND O9/2*125+(W8*H8*SIN(W3*.01745))<S THEN
 ' '  S=S-(RND(1)*50):A=0
00850 IF V>5000 OR T8>30 THEN S=S-(RND(1)*130)
00860 IF G=0 THEN A=A-.1
00870 IF L=0 THEN A=A-((K*K3*B)/80)
00880 IF A1=1 AND A<>32 THEN A=0:T8=0:T9=0:P=0
00890 S=A/5280*3600*T1+S:IF S>999 THEN S=999
00900 IF S<0 THEN S=0
00910 Z=S-40:IF Z<0 THEN Z=0
00920 IF R9>2 AND R9<5 AND L=0 THEN
 ' '  V9=V9+(Z*T1/3600*5280):IF V9>9500 THEN Z=4:GOTO 1320
00930 IF R9=7 AND L=0 THEN V8=V8+((S-40)*T1/3600*5280):IF
 ' '  V8>9500 THEN Z=4:GOTO 1320
00940 V=S*88*SIN(T9):IF ABS(V)>9999 THEN V=SGN(V)*9999
00950 L=V/60*T1+L:IF L<=0 THEN T8=0:L=0
00960 IF G8=0 AND L>0 THEN G8=2
00970 IF G8=2 THEN GOSUB 2320
00980 W8=H9*L/3000
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00990 IF C1>57 OR C1<46 THEN 1070
01000 IF S1=1 THEN P=P+5
01010 IF S1=2 THEN P=P-5
01020 IF S1=0 THEN P=0:H=0
01030 IF ABS(P)>45 THEN P=45*SGN(P)
01040 IF S=0 THEN 1090
01050 IF S1=3 THEN H=H+(5*(RND(1)+.5))
01060 IF S1=4 THEN H=H-(5*(RND(1)+.5))
01070 D=H/2*(RND(1)+.5)+D:IF D>360 THEN D=D-360
01080 IF D<0 THEN D=D+360
01090 W3=W9+180-D:IF W3>360 THEN W3=W3-360
01100 IF W3<0 THEN W3=W3+360
01110 H8=1:IF (W3>90 AND W3<180) OR W3>270 THEN H8=-1
01120 W6=W8*H8*SIN(W3*.01745)+S:W7=W8*H8*COS(W3*.01745):W5=S
  ' '  GN(W6):W6=ABS(W6)
01130 IF W5=0 THEN W2=0:GOTO 1150
01140 W2=W5*57.295*ATN(W7/W6)
01150 D5=S*T1/4800:B5=D+W2:IF B5>360 THEN B5=B5-360
01160 IF B5<0 THEN B5=B5+360
01170 B5=B5*.01745:N=N-(D5*SIN(B5)/51):T=T+(D5*COS(B5)/72):I
  ' '  F C3=0 THEN 1200
01180 K=K-(RND(1)*20):IF K<0 THEN K=0
01190 Z1=2:X=47:V=85:Z2=K:GOSUB 90:GOTO 1210
01200 IF RND(1)<.0005 THEN C3=1
01210 IF RND(1)<.0005 THEN 1260
01220 IF L=0 OR U9=1 OR (G8=1 AND L>100) OR (D<357 AND
  ' '  D>48) THEN 40
01230 IF D>3 AND D<42 THEN 40
01240 IF T>41.92 AND T<41.99 AND N>72.66 AND N<72.77 THEN
  ' '  GOSUB 1930
01250 GOTO 40
01260 Z=RND(1):V=INT(RND(1)*4)+1:09=V
01270 Z1=0:IF Z<.25 THEN O(V)=1:X=42:GOTO 1310
01280 IF Z<.5 THEN H(V)=1:X=43:GOTO 1310
01290 IF Z<.75 THEN W(V)=1:X=44:GOTO 1310
01300 F(V)=1:X=45
01310 V=V+66:GOSUB 90:PRINT G$;"↑":GOTO 1250
01320 PRINT CHR$(27);CHR$(89);CHR$(56);CHR$(32)
01330 PRINT CHR$(7);"Your aircraft has crashed. In 30
  ' '  seconds the panel will be erased.";
01340 PAUSE 15000:PRINT CHR$(27);CHR$(122);CHR$(27);CHR$(69)
01350 ON Z+1 GOTO 1360,1520,1570,1610,1650
01360 IF V>0 THEN 1470
01370 IF V<-1000 THEN 1440
01380 PRINT "  Your rate of descent was too fast. The
  ' '  landing gear struts"
01390 PRINT "broke on impact and sent the plane scraping
  ' '  along the ground."
01400 PRINT "One of the fuel tanks ignited due to sparks
  ' '  created by the"
01410 PRINT "aircraft. Two of your passengers were killed,
  ' '  47 were"
01420 PRINT "seriously injured. The rest escaped with only
  ' '  minor"
01430 PRINT "cuts and bruises.":GOTO 1700
01760 R8=0:V=0:FOR V1=0 TO 4
01770 X=INT(RND(1)*9):IF X=V THEN 1770
01780 R8=(X*(10↑V1))+R8:V=X:NEXT V1:R8=INT(R8)
01790 PRINT #1,TAB(20);"Please tune frequency to";R8;"Mhz."
01800 CLOSE #1:R9=1:GOTO 720
01810 OPEN "AT:" FOR WRITE AS FILE #1
01820 GOSUB 2310:PRINT #1,"Trans World 409, proceed to
  ' '  runway";
01830 R7=INT(RND(1)*3):IF R7=0 THEN PRINT #1," 00 .":GOTO
  ' '  1850
01840 PRINT #1,R7*45;"."
01850 PRINT #1,"Weather Report:"
01860 PRINT #1,"Ground winds:";W9+(RND(1)*20)-10;"Degrees
  ' '  at";H9;"Mph."
01870 PRINT #1,"30,000 Feet:";W9;"Degrees at";H9*11;"Mph."
01880 PRINT #1,"Sky conditions: 20,000 Scattered   30,000
  ' '  Broken."
01890 CLOSE #1:R9=2:GOTO 720
01900 OPEN "AT:" FOR WRITE AS FILE #1
01910 GOSUB 2310:PRINT #1,"Trans World 409, hold for
  ' '  clearance.":GOSUB 1930
01920 GOTO 1970
01930 IF G8=1 AND W=0 THEN RETURN
01940 FOR Z=1 TO 6:PRINT
  ' '  CHR$(27);CHR$(89);CHR$(Z+32);CHR$(61-Z);G$;CHR$(120)
01950 PRINT
  ' '  CHR$(27);CHR$(89);CHR$(Z+32);CHR$(81+Z);G$;CHR$(121):P
  ' '  AUSE 1000
01960 NEXT Z:IF G8=1 THEN U9=1:RETURN
01970 R9=3:CLOSE #1:GOTO 720
01980 OPEN "AT:" FOR WRITE AS FILE #1
01990 GOSUB 2310:PRINT #1,"Trans World 409, You are now
  ' '  cleared for takeoff."
02000 PRINT #1,"Proceed on flight pattern ";
02010 IF R7=0 THEN PRINT #1,"B"
02020 IF R7=1 THEN PRINT #1,"A"
02030 IF R7=2 THEN PRINT #1,"C"
02040 PRINT #1,"Level at";INT(RND(1)*5+15)*1000;"feet."
02050 R9=4:CLOSE #1:GOTO 720
02060 OPEN "AT:" FOR WRITE AS FILE #1
02070 GOSUB 2310:PRINT #1,"Trans World 409, This is JFK
  ' '  flight control."
02080 PRINT #1,"You are now leaving our radar scan.":CLOSE
  ' '  #1:R9=5:GOTO 720
02090 OPEN "AT:" FOR WRITE AS FILE #1
02100 GOSUB 2310
02110 GOSUB 2310:PRINT #1,"Trans World 409, You are now
  ' '  entering Bradley"
02120 PRINT #1,"radar field. Proceed
  ' '  to";INT(RND(1)*5+5)*1000;"feet."
02130 CLOSE #1:R9=6:GOTO 720
02140 OPEN "AT:" FOR WRITE AS FILE #1
02150 GOSUB 2310:PRINT #1,"Trans World 409, You are cleared
  ' '  into runway ";
02160 IF R7=0 THEN PRINT #1,"45"
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01440 PRINT "  Your rate of descent was too fast. Your
 ' '  aircraft slammed"
01450 PRINT "into the ground and blew apart on impact.
 ' '  There were no"
01460 PRINT "survivors.":GOTO 1700
01470 PRINT "  Your climb rate was much too fast. The
 ' '  G-force was too"
01480 PRINT "much for the aircraft. Major damages occurred
 ' '  in the control"
01490 PRINT "lines, and the water flow to engines 1 and 2
 ' '  were cut off."
01500 PRINT "The engines blew apart, taking the rest of the
 ' '  aircraft"
01510 PRINT "with it.":GOTO 1700
01520 PRINT "  You have landed flight 409 off the runway.
 ' '  As your"
01530 PRINT "aircraft rolled through the residential area,
 ' '  5 homes"
01540 PRINT "were totally destroyed. Six people were killed
 ' '  and"
01550 PRINT "scores of others were seriously injured.
 ' '  Seventeen"
01560 PRINT "passengers were killed and 120 are
 ' '  critical.":GOTO 1700
01570 PRINT "  You have landed your aircraft with the
 ' '  landing gear up."
01580 PRINT "As the aircraft scraped along the ground,
 ' '  sparks ignited"
01590 PRINT "one of the fuel tanks. The explosion blew
 ' '  apart the wing of your"
01600 GOTO 1410
01610 PRINT " You neglected to shut down engine";09;". The
 ' '  engine blew"
01620 PRINT "apart and flames quickly spread to a nearby
 ' '  fuel tank."
01630 PRINT "The resulting explosion ruptured the fuselage
 ' '  and your"
01640 PRINT "aircraft disintegrated in mid-air.":GOTO 1700
01650 PRINT "  You have run out of runway. Your aircraft
 ' '  slammed into"
01660 PRINT "the barrier at the end of the runway, killing
 ' '  everyone in"
01670 PRINT "the first four rows of the first class
 ' '  section. Many"
01680 PRINT "people received major injuries from the
 ' '  impact. The"
01690 PRINT "aircraft was badly damaged."
01700 PRINT :PRINT :PRINT "Please press and hold the CTRL
 ' '  key, and then"
01710 PRINT "the C key to end the simulation.":PRINT
01720 PRINT "Thank you for flying Trans World Airlines."
01730 GOTO 1730
01740 OPEN "AT:" FOR WRITE AS FILE #1:FOR Z=1 TO 13:PRINT
 ' '  #1,:NEXT Z
01750 GOSUB 2310
02170 IF R7<>0 THEN PRINT #1,"00"
02180 PRINT #1,"Begin descent.":CLOSE #1:R9=7:GOTO 720
02190 OPEN "AT:" FOR WRITE AS FILE #1
02200 GOSUB 2310:PRINT #1,"Trans World 409, turn to 90 and
 ' '  proceed to"
02210 PRINT #1,"gate 1A":GOSUB 2320:G8=0:CLOSE #1:R9=8:GOTO
 ' '  720
02220 A$=G$+"iiiiiiiiii"
02230 FOR Z=1 TO 2:PRINT
 ' '  CHR$(27);CHR$(89);CHR$(33+Z);CHR$(60);A$:NEXT Z
02240 PRINT
 ' '  CHR$(27);CHR$(89);CHR$(36);CHR$(60);G$;"iiii";n$;"GATE
 ' '   1"
02250 FOR Z=1 TO 2:PRINT
 ' '  CHR$(27);CHR$(89);CHR$(36+Z);CHR$(60);A$:NEXT Z
02260 FOR Z=1 TO 5:PRINT
 ' '  CHR$(27);CHR$(89);CHR$(33+Z);CHR$(73);A$:NEXT Z
02270 R9=9:GOTO 720
02280 PRINT CHR$(27);CHR$(89);CHR$(56);CHR$(32)
02290 PRINT "Welcome to Hartford. You sucessfully landed
 ' '  your aircraft!";
02300 PAUSE 3000:PRINT
 ' '  CHR$(27);CHR$(122);CHR$(27);CHR$(69):GOTO 1700
02310 PRINT #1,:PRINT #1,:FOR Z=1 TO 5:PRINT
 ' '  #1,CHR$(7):NEXT Z:RETURN
02320 IF G8=1 AND W=0 THEN RETURN
02330 IF G8=2 THEN G8=1
02340 FOR Z=1 TO 6:PRINT
 ' '  CHR$(27);CHR$(89);CHR$(Z+32);CHR$(61-Z);N$;CHR$(32)
02350 PRINT
 ' '  CHR$(27);CHR$(89);CHR$(Z+32);CHR$(81+Z);N$;CHR$(32)
02360 PAUSE 800:NEXT Z:RETURN
02370 IF G8<>0 THEN 720
02380 GOTO 1740
02390 IF R<>R8 THEN 720
02400 GOTO 1810
02410 IF D>R7*45+3 OR D<R7*45-3 THEN 720
02420 GOTO 1900
02430 IF S<>0 OR RND(1)<.75 THEN 720
02440 GOTO 1980
02450 IF T<41.2 AND N>72.85 THEN 720
02460 GOTO 2060
02470 IF T<41.25 AND N>73.25 THEN 720
02480 GOTO 2090
02490 IF T<41.32 AND N>73.18 THEN 720
02500 GOTO 2140
02510 IF L<>0 OR S>50 THEN 750
02520 GOTO 2190
02530 K9=S*T1/3600+K9:IF K9<.5 THEN 720
02540 GOTO 2220
02550 IF S<>0 OR B<>4 THEN 750
02560 GOTO 2280

                                    ***END OF FILE***
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Free Literature

- **Computer-based Service.** A four-color brochure describes a system that combines typography with graphics ready for reproduction by a variety of processes. The service can also integrate type and graphics into page formats. Infoconversion, 280 Crossways Park Dr., Woodbury, NY 11797, (516) 575-2093. CIRCLE INQUIRY NO. 151

- **Correct Ribbon Cable.** A ribbon cable connector selector chart helps in selecting the right one for a particular requirement. The chart lists electrical specifications, number of contacts, dimensions and part numbers. TRW Cinch Connectors, 1501 Morse Ave., Elk Grove Village, IL 60007. CIRCLE INQUIRY NO. 152

- **Storage Planning.** A 16-page instant storage catalog offers equipment, illustrations and space saving ideas on storage. Included is steel shelving, pallet racking, storage retrieval and mezzanine systems, lockers, gondolas, benching and shop equipment. Bernard Franklin Co., 4424 Paul St., Philadelphia, PA 19124, (215) 744-9300. CIRCLE INQUIRY NO. 153

- **Superman Meets TRS-80.** 'The Computers That Saved Metropolis' is a comic book combining factual information about microcomputers with a typical Superman adventure. It is available for schools, clubs, youth groups, and individuals from participating Radio Shack stores and dealers. CIRCLE INQUIRY NO. 154

- **DP Cabinets and Equipment.** A four-page brochure describes the Spectron line of data communication cabinets and paraphernalia for organizing a network management system. Spectron, 344 New Albany Rd., Box 620, Moorestown, NJ 08057, (609) 234-5700. CIRCLE INQUIRY NO. 155

- **Components Cataloged.** An eight-page brochure lists such component parts available as bus bars, heat sinks, flex circuits, diode driver modules and diode arrays. Basic Electronics, Inc., 11762-Q Western Ave., Stanton, CA 90680, (714) 530-2400. CIRCLE INQUIRY NO. 156

- **Interface Guide.** A booklet serves as an alternative to the exhaustive installation manual for MFE floppy disk drives. MFE Corp., Keewaydin Dr., Salem, NH 03709, (800) 258-3884. CIRCLE INQUIRY NO. 157

- **Disk Drive Data.** A data sheet describes the SA4100 14-inch disk drive, comparing it to the SA4000 model. Kevin Burr, Shugart, 475 Oakmead Pkwy., Sunnyvale, CA 94086, (408) 733-0100. CIRCLE INQUIRY NO. 158

- **Hard-to-Find Tools.** A catalog of tools for electronic assembly and precision mechanics, including micro-tools, test equipment, drafting supplies. Jensen Tools, 1230 S. Priest Dr., Tempe, AZ 85281. CIRCLE INQUIRY NO. 159

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